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TRANSACTIONS

OF THE

New England

COTTON MANUFACTURERS' ASSOCIATION.

Founded July 25, 1865. Incorporated Dec. 1, 1894.

No. 60.

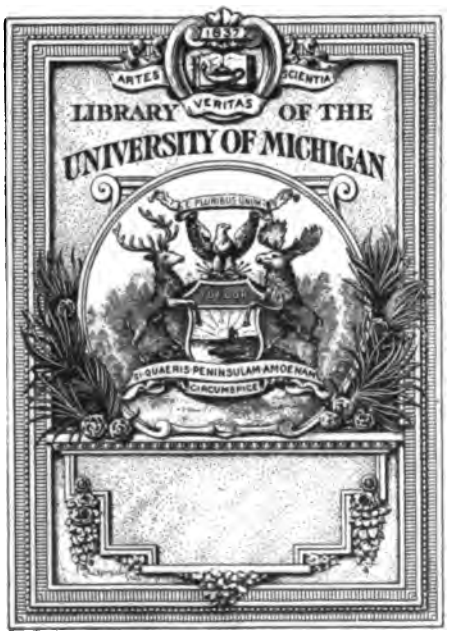
ANNUAL MEETING.

HELD AT CHIPMAN HALL, TREMONT TEMPLE,
BOSTON, MASS., APRIL 29-30, 1896.

Office of the Association:

801 John Hancock Building, No. 178 Devonshire St., Boston, Mass.

WALTHAM, MASS.:
PRESS OF E. L. BARRY.
1896.



THE GIFT OF

Association.

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Arthur H. Lowe.

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OF THE

New England

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PRESS OF E. L. BARRY,
1896.

Entered according to Act of Congress
in the Year 1896
By the New England Cotton Manufacturers' Association,
In the Office of The Librarian of Congress
at Washington.

By vote of the Board of Government, the price of the *Transactions* is $5.00 per copy for non-members, and 50 cents per copy for members for extra copies, in addition to the one to which they are entitled as a part of the privilege of membership.

CHARTER.

No. 6091.

Commonwealth of Massachusetts.

BE IT KNOWN, That whereas, EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN have associated themselves with the intention of forming a corporation under the name of the NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION, for the purpose of encouraging scientific investigation and experiment as to the methods of manufacturing cotton; collecting and imparting information relating to this industry, promoting social intercourse among its members; and establishing and maintaining a library of works on textiles in the city of Boston, and have complied with the provisions of the Statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer and Directors of said corporation, duly approved by the Commissioner of Corporations, and recorded in this office.

Now, Therefore, I, WILLIAM M. OLIN, Secretary of the Commonwealth of Massachusetts, do hereby certify that said EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN, their associates and successors, are legally organized and established as and are hereby made an existing corporation under the name of the

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,

with the powers, rights and privileges, and subject to the limitations, duties and restrictions which by law appertain thereto.

Seal of the Commonwealth of Massachusetts.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed this first day of December, in the year of our Lord one thousand eight hundred and ninety-four.

WILLIAM M. OLIN,

Secretary of the Commonwealth.

197060

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

FOUNDED JULY 26, 1865.

INCORPORATED DECEMBER 1, 1894.

CONSTITUTION AND BY-LAWS.

ACTIVE MEMBERS.

ARTICLE 1. Any person who is actively engaged as President, Treasurer, Agent, Superintendent or Manager in the manufacture, printing or finishing of cottons shall be eligible for active membership.

ELECTION OF MEMBERS.

ARTICLE 2. All nominations for membership shall be made in writing, at least one week before the date of any regular meeting, and shall be considered by the Board of Government, and reported to the meeting, favorably or adversely, for the action of the Association. *Provided*, that in case the Board shall decide to report adversely upon any nomination, the member who shall have made it shall be informed of the intention so to report, in order that he may have an opportunity to withdraw the name. Upon such report active members may be admitted, if they obtain a majority of votes of the members present and voting therefor, by acceptance in writing, and paying an admission fee of ten dollars, and maintaining their membership by the payment of an annual assessment not exceeding ten dollars. Any member failing to pay two successive assessments shall cease to be a member at the end of six months from the date when such second assessment shall become due. Any member may withdraw from the Association upon payment of all arrearages, first giving notice of his intention so to do, in writing, to the Secretary, and the Board of Government may accept such resignation; and any member may be expelled for cause,

at any regular meeting, two-thirds of the members present voting therefor.

ASSOCIATE MEMBERS.

ARTICLE 3. Persons engaged in the manufacture of cotton or cotton fabrics, or the manufacture of textile machinery, or industries kindred to the cotton manufacture, may become associate members of the Association. The methods of application, nomination, election and withdrawal from the Association being under the same conditions as those provided for active members in Article 2, excepting that this class of membership does not carry with it the privilege of voting or speaking, except by permission from the Board of Government or a vote of the Association to allow permission.

The initiation fee for associate members shall be twenty-five dollars, and the annual assessment shall be double the sum annually voted for active members.

Associate members may be expelled by a majority vote of the Board of Government.

HONORARY MEMBERS.

ARTICLE 4. Honorary members may be elected, when recommended by the Board of Government, at any regular meeting of the Association, who shall be enrolled as such, and shall be entitled to attend the meetings of the Association and participate in its proceedings, without the right to vote. They shall not be subject to payment of admission fees or assessments. No person actively engaged in cotton manufacture shall be eligible to honorary membership.

ARTICLE 5. It shall be the duty of all members of the Association to make returns to the Secretary of such statistics as may be called for by him, under the direction of any committee duly appointed for the collection of statistics, when not incompatible with private interests.

OFFICERS.

ARTICLE 6. The officers of this Association shall be a President, two Vice-Presidents, six Directors, a Treasurer, Secretary, and Auditor of Accounts.

ELECTION OF OFFICERS.

ARTICLE 7. At each annual meeting there shall be chosen by ballot a President, two Vice-Presidents and two Directors; the President and Vice-Presidents to serve one year, and the two Directors shall be chosen for terms of three years.

DUTIES OF OFFICERS.

ARTICLE 8. The President, or in his absence the senior Vice-President present, shall preside at all meetings of the Association and of the Board of Government. All officers shall hold their respective offices until their successors shall be chosen and accept their positions.

ARTICLE 9. The President, Vice-Presidents and Directors shall constitute a Board of Government, and have under their care and direction all matters pertaining to the management of the Association; and five of their number shall constitute a quorum for the transaction of business. Meetings of the board may be called by the President, at such time and place as he may deem expedient, giving each member a written or printed notice of the same at least five days before the day of meeting. At their first meeting the board shall elect a Treasurer, Secretary, and Auditor of Accounts for the year ensuing, and fix the amount of compensation of the Secretary. All vacancies in their board occasioned by death or resignation shall be filled by the board; and the persons so elected shall hold their offices until the next annual meeting. The board may, from time to time, as they shall deem expedient, appoint committees, from among their own board or from the members at large, to collect statistical information, examine new inventions or processes in manufacturing goods, as also to prepare essays on subjects of interest to the Association.

ARTICLE 10. The Treasurer shall keep a book in which all receipts and payments of money shall be entered, collect all moneys due the Association, and disburse the same upon the written order of the Board of Government. At the annual meeting in each year he shall make an exhibit of his accounts, or oftener if the Board of Government require it. He shall notify the members of assessments voted, and cause them to be collected in a reasonable time.

ARTICLE 11. The Secretary shall attend all meetings of the Association and of the Board of Government, and keep accurate records of

their doings. In the absence of the Secretary at any meeting, a Secretary *pro tem.* may be appointed by the presiding officer, who shall be sworn to do all things, while in office, required of the Secretary.

ARTICLE 12. The Auditor shall examine the accounts of the Treasurer annually, and report at each meeting the state of the finances.

MEETINGS.

ARTICLE 13. The annual meeting of the members of the Association shall be held on the last Wednesday of April, or at such other time, and at such hour and place as the Board of Government may appoint. There shall also be a semi-annual meeting of the Association on the last Wednesday of October, in each and every year, or at such other time, and at such place and hour as the Board of Government may appoint.

Special meetings may be called by the Board of Government whenever they deem it expedient, or upon the written application of any ten members, made to the Secretary.

ARTICLE 14. All meetings of the members of the Association shall be in pursuance of a written or printed notice, addressed to each member, with the name of the President or Secretary attached thereto, and deposited in the Post Office ten days at least before the day of meeting, specifying the time and place of meeting; and at all such meetings fifteen members shall constitute a quorum for the transaction of business.

ARTICLE 15. Amendments to the By-Laws may be made at any stated meeting of the Association by a two-thirds vote; *provided*, notice of such proposed amendment be given in writing at a previous meeting, and also notice be given to each member by the Secretary, of the pendency of such amendment, ten days at least before any such meeting.

BOARD OF GOVERNMENT.

1896.

PRESIDENT.

ARTHUR H. LOWE, ... FITCHBURG, MASS.

VICE-PRESIDENTS.

WILLIAM J. KENT, ... NEW BEDFORD, MASS.
FRED. C. McDUFFIE, ... BOSTON, MASS.

DIRECTORS.

ALBERT F. KNIGHT, ... ADAMS, MASS.
HENRY T. WHITIN, ... NORTHBRIDGE, MASS.
HERBERT L. PRATT, ... LEWISTON, ME.
STEPHEN A. KNIGHT, ... PROVIDENCE, R. I.
JOHN ECCLES, ... TAFTVILLE, CONN.
RUSSELL W. EATON, ... BRUNSWICK, ME.

AUDITOR.

J. H. SAWYER, ... BOSTON, MASS.

SECRETARY.

C. J. H. WOODBURY, P. O. BOX 3672, BOSTON, MASS.

OFFICERS OF THE ASSOCIATION.

FROM THE FIRST ORGANIZATION.

PRESIDENTS.

Ezekiel A. Straw,	1865–78	Henry F. Lippitt,	1888–89
Amos D. Lockwood,	1878–80	Walter E. Parker,	1889–92
John Kilburn,	1880–83	Robert McArthur,	1892–94
William C. Lovering,	1883–85	Edw. W. Thomas,	1894–95
Richard Garsed,	1885–86	A. M. Goodale,	1895-96.
J. S. Ludlam,	1886–88	ARTHUR H. LOWE,	1896.

VICE-PRESIDENTS.

Amos D. Lockwood,	1865–77	Walter E. Parker,	1885–89
William A. Burke,	1865–73	Richard B. Borden,	1886–88
John C. Palfrey,	1873–76	Arnold B. Sanford,	1888–91
Edward Atkinson,	1876–78	Robert McArthur,	1889–92
A. G. Cumnock,	1877–80	Simeon B. Chase,	1891–93
Charles Nourse,	1878–81	E. W. Thomas,	1892–94
William F. Goulding,	1880–83	A. M. Goodale,	1893-95
Richard Garsed,	1881–85	WILLIAM J. KENT,	1894
J. S. Ludlam,	1883–86	FRED. C. McDUFFIE,	1895

DIRECTORS.

J. S. Davis,	1865–69	A. M. Wade,	1868–69
Charles Nourse,	1865–78	D. J. Johnston,	1869–70
Phineas Adams,	1865–74	A. G. Cumnock,	1869–77
William P. Haines,	1865–69	F. E. Clarke,	1869–75
Thomas J. Borden,	1865–78	John Kilburn,	1870-80
Daniel D. Crombie,	1865–68	William P. Haines,	1874–78

DIRECTORS.—Concluded.

Cyrus I. Barker,	1875–80	Robert McArthur,	1886–89
Hervey Kent,	1877–81	S. S. Spencer,	1887–90
David J. Johnston,	1878–82	E. W. Thomas,	1888–92
Walter Paine, 3d,	1878–80	William W. Whitin,	1888–93
Chas. L. Lovering,	1878–83	Robert R. Smith,	1889–92
Richard Garsed,	1880–81	Alfred M. Goodale,	1890–93
William H. Jennings,	1880–83	William J. Kent,	1891–94
Chas. D. McDuffie,	1881–83	Herman F. Straw,	1891–93
Walter E. Parker,	1881–85	Fred C. McDuffie,	1892–95
John W. Danielson,	1881–85	George W. Bean,	1892–95
William E. Barrows,	1882–83	F. M. Messenger,	1893–95
Rufus A. Maxfield,	1883–86	Arthur H. Lowe,	1894-96
George W. Weeks,	1883–86	ALBERT F. KNIGHT,	1893
Henry S. Howe,	1883–87	HENRY T. WHITIN,	1894
Richard B. Borden,	1883–86	JOHN ECCLES,	1895
O. S. Brown,	1885–91	HERBERT L. PRATT,	1895
Henry F. Lippitt,	1885–88	STEPHEN A. KNIGHT,	1895
Wilbur A. Stiles,	1886–88	RUSSELL W. EATON,	1895
Stephen N. Bourne,	1886–91		

AUDITORS.

Benjamin Saunders,	1865–71	Henry D. Sullivan,	1873–82
John C. Palfrey,	1871–73	JACOB H. SAWYER,	1882

SECRETARY AND TREASURER.

Ambrose Eastman,	1865–94	C. J. H. WOODBURY,	1894

MEMBERS OF THE ASSOCIATION.

May 1, 1896.

Members of the Association are respectfully requested to scrutinize the following list, and advise the Secretary, P. O. Box 3672, Boston, Mass., of change in address, of any error in regard to their names; also to inform him of the decease of fellow members residing in their vicinity.

The earliest published list of membership in the Association is dated 1866, and the names in the present list of membership which occur in this first list are recorded as dating from the first meeting, July 26, 1865.

HONORARY MEMBERS.

GEORGE ARMS	Grand Hotel	New York City	Oct. 16, 1872.
AMBROSE EASTMAN	53 State St.	Boston, Mass.	Sept. 27, 1894.

ACTIVE MEMBERS.

Stephen I. Abbott,	Agt. Lockwood Co.	Waterville, Me.	Apr. 21, 1869.
Alfred E. Adams	Supt. Whitinsville Cotton Mills	Whitinsville, Mass.	Apr. 27, 1887.
John S. Adams, Jr.,	Supt. Adams Bros. Mfg. Co.	Adams, Mass.	Apr. 29, 1896.
Stephen L. Adams	Treas. Stafford Mfg. Co.	Central Falls, R. I.	Apr. 24, 1895.
Joseph D. Aiken	Ponemah Mills	Taftville, Conn.	Oct. 28, 1891.
F. S. Akin	Supt. Cornell Mills	Fall River, Mass.	Sept. 27, 1894.
Charles T. Aldrich	Treas. Aldrich Mfg. Co.	Box 34, Providence, R. I.	Apr. 28, 1886.
George E. Ames	Mech. Supt. Lawrence Mfg. Co.	Lowell, Mass.	Apr. 24, 1895.
William Ames	Treas. Fletcher Manufg. Co.	Providence, R. I.	Apr. 30, 1879.
Charles B. Amory	Treas. Hamilton Manufg. Co.	Boston, Mass.	Apr. 25, 1894.
John W. Arrington	Treas. & Agt. Edna Cotton Mills	Reidsville, N. C.	Oct. 25, 1895.
Abel T. Atherton	Prest. A. T. Atherton Machine Co.	108 Clay St., Central Falls, R. I.	Oct. 16, 1872.
Edward Atkinson	Prest. Boston Mfrs. Mu. Fire Ins. Co.	Boston, Mass.	Apr. 19, 1871.
Edward W. Atkinson	Stoddard, Haserick Richards Co.	152 Congress St., Boston, Mass.	Oct. 27, 1886.
H. C. Atwood	Treas. Williamsville Manufg. Co.	Killingly, Conn.	Apr. 29, 1885.
James A. Atwood	Agt. Wauregan Mills	Wauregan, Conn.	Oct. 28, 1891.
John Walter Atwood	Supt. Wauregan Mills	Wauregan, Conn.	Oct. 25, 1895.
W. E. Atwood	Secy. and Asst. Treas. Williamsville Manufg. Co.	Killingly, Conn.	Sept. 27, 1894.
Geo. A. Ayer	Supt. City Manufg. Corporation	New Bedford, Mass.	Apr. 24, 1895.

Charles L. Bailey	Supt. Boston Manufg. Co.	Waltham, Mass.	Sept. 27, 1894.
Henry A. Bailey	Agt. Chicopee Manufg. Co.	Chicopee Falls, Mass.	Oct. 25, 1893.
Edwin H. Baker	Bliss, Fabyan & Co.	Box 2899, New York	Apr. 24, 1878.
Philip S. Baker	Treas. Crowders Mountain Cotton Mills,	Kings Mt., N. C.	Oct. 25, 1895.
Edward R. Ballou	Supt. Brighton Mills	540 West 23rd St., N. Y.	Apr. 25, 1894.
William P. Bancroft	V. P. James Bancroft & Sons Co.	Wilmington, Del.	Oct. 31, 1883.
A. D. Barker	Agt. Avon Manufg. Co.	Lewiston, Me.	Apr. 19, 1871.
Lewis E. Barnes	Supt. Methuen Co.	Methuen, Mass.	Oct. 25, 1895.
William A. Barrell	Agt. Lawrence Duck Co.	Lawrence, Mass.	Apr. 30, 1884.
Edwin N. Bartlett	Supt. Sigourney Mill	North Oxford, Mass.	Apr. 29, 1891.
Joseph P. Battles	Supt. Nonantum Worsted Co.	Newton, Mass.	Oct. 25, 1895.
George W. Bean	Agt. Androscoggin Mills	Lewiston, Me.	Apr. 17, 1872.
Truman Beckwith	Treas. Dyerville Manufg. Co.	Box 171, Prov., R. I.	Apr. 17, 1892.
W. H. Blackstone	Treas. Attawaugan Co.	Norwich, Conn.	Apr. 29, 1896.
William W. Blades	Supt. Crefeld Mills	Westerly, R. I.	Oct. 25, 1893.
Nathaniel B. Borden	Treas. Barnard Manufg. Co.	Fall River, Mass.	Oct. 15, 1873.
Richard B. Borden	Treas. Richard Borden Mfg. Co. Treas. Troy C. & W. Mfg. Co.	Fall River, Mass.	July 26, 1865.
Thomas J. Borden	Pres. Richard Borden Manufg. Co.	Box 18, Fall River, Mass.	July 26, 1865.
E. S. Boss	Agt. Willimantic Linen Co.	Willimantic, Conn.	Oct. 29, 1879.
Stephen N. Bourne	Agt. Stark Mills	Manchester, N. H.	Oct. 21, 1868.
Arthur F. Brackett	Supt. Riverpoint & Arctic Mills	Riverpoint, R. I.	Oct. 25, 1895.
Ernest Bridge	Supt. Jas. Chadwick & Bro. Ltd.	Jersey City, N. J.	Apr. 24, 1895.
Walter D. Brigham	Asst. Supt. Willimantic Linen Co.	Willimantic, Conn.	Apr. 24, 1895.
John W. Brown	Agt. Warren Cotton Mills	West Warren, Mass.	Oct. 25, 1895.
O. S. Brown	Agt. Salmon Falls Manufg. Co.	Salmon Falls, N. H.	Apr. 21, 1875.
E. C. Bucklin	Treas. Interlaken Mills, Treas. Harris Mfg. Co.	Box 289, Providence, R. I.	Apr. 25, 1883.
Robert Burgess	Supt. Pierce Mfg. Corp.	New Bedford, Mass.	Apr. 27, 1892.
Edward N. Burke	Lowell Machine Shop	Lowell, Mass.	Apr. 29, 1880.
W. R. Burnham	Treas. Uncasville Manufg. Co.	Norwich, Conn.	Apr. 29, 1885.
William D. Cadwell	Agt. Nashua and Jackson Companies,	Nashua, N. H.	Apr. 19, 1871.
Byron F. Card	Agt. New Bedford Manufg. Co.	New Bedford, Mass.	Apr. 25, 1888.
Arnold B. Chace, Jr.	Agt. Woonsocket Mills	Valley Falls, R. I.	Apr. 24, 1895.
George A. Chace	Treas. Bourne Mills	Fall River, Mass.	Apr. 25, 1877.
H. S. Chadwick	Pres. Dover Yarn Mill	Charlotte, N. C.	Apr. 24, 1895.
Simeon B. Chase	Treas. King Philip Mills	Fall River, Mass.	Apr. 21, 1875.
Clarence N. Childs	Asst. Supt. Hamilton Manufg. Co.	Lowell, Mass.	Apr. 24, 1895.
Elmer G. Childs	Agt. Boston Duck Co.	Bondsville, Mass.	Oct. 26, 1892.
Alfred Clarke	Eastern Electric Light and Storage Battery Co.	Lowell, Mass.	Apr. 30, 1879.
Ernest E. Clark	Supt. Sutton Mfg. Co.	Wilkinsonville, Mass.	Apr. 29, 1896.
Fred E. Clarke	Agt. Pemberton Co.	Lawrence, Mass.	July 26, 1865.
George A. Clark	Supt. Manchester Mills	Manchester, N. H.	Oct. 25, 1882.

Jeremiah Clark	Textile Machinery,	277 Dutton St., Lowell, Mass.	Oct. 15, 1873.
J. William Clark	Clark Thread Co.	Newark, N. J.	Oct. 26, 1892.
Alonzo A. Coburn	Whitehead Machine Co.	Lowell, Mass.	Apr. 25, 1888.
Josiah G. Coburn		Newton, Mass.	July 26, 1865.
John A. Collins	Supt. American Linen Co.	73 Cottage St., Fall River, Mass.	Oct. 31, 1883.
Frank B. Comins	Vice-Pres. & Gen. Mgr. Aerphor Co.	P. O. Box 1555, Providence, R. I.	Oct. 28, 1891.
John J. Connell	Supt. Cohannet Mills,	Taunton, Mass.	Apr. 27, 1892.
Alphonse S. Covel	Treas. Tremont and Suffolk Mills	P. O. Box 1716, Boston, Mass.	Oct. 31, 1877.
A. G. Cumnock	Agt. Boott Cotton Mills	Lowell, Mass.	Oct. 28, 1885.
Andrew J. Currier	Man'gr Albion Mills	Albion, R. I.	Apr. 25, 1888.
T. B. Dallas	Treas. Dallas Manufg. Co.	Nashville, Tenn.	Oct. 25, 1895.
Woodbury K. Dana	Treas. Dana Warp Mills	Westbrook, Me.	Apr. 25, 1888.
Albert W. Danforth	Supt. & Chief Engineer Shanghai Cot. Cloth Co., Shanghai, China	881 Bridge St., Lowell, Mass.	Apr. 27, 1881.
A. Lockwood Danielson	Asst. Treas. Quinebaug Co.	Box 900, Providence, R. I.	Sept. 27, 1894.
J. DeForest Danielson	Asst. Treas. Lockwood Co.	Providence, R. I.	Sept. 27, 1894.
John W. Danielson	Treas. Lockwood Co.	Box 900, Providence, R. I.	July 15, 1868.
B. D. Davol	P. O. Box 418	Fall River, Mass.	Apr. 25, 1877.
James C. Deane	Supt. Griswoldville Manufg. Co.	Griswoldville, Mass.	Apr. 25, 1894.
William P. Dempsey	Agt. Dempsey Bleachery and Dye Works	Pawtucket, R. I.	Apr. 28, 1886.
Charles W. Dennett	Agt. Johnson Manufg. Co. Agt. Dunbar Mills Co.	North Adams, Mass.	Oct. 29, 1890.
Edward P. Dennis	Lowell Machine Shop	Lowell, Mass.	Apr. 25, 1888.
Charles A. Denny	Gen. Mangr. Amer. Card Clothing Co.	Leicester, Mass.	Apr. 25, 1888.
P. Y. DeNormandie	Supt. Potomska Mills	New Bedford, Mass.	Apr. 29, 1896.
Chas. Owen Dexter	Mgr. Canadian Col'd Cot. Mills, Ltd.	Hamilton, Ont.	Apr. 24, 1895.
George Dexter	Treas. Pepperell and Laconia Cos.	30 Kilby St., Boston, Mass.	Oct. 31, 1877.
F. Dilling	Sec'y. & Treas. Dilling Cotton Mills	Kings Mountain, N. C.	Oct. 25, 1895.
Chas. C. Diman	Treas. and Agt. Whitman Mills	New Bedford, Mass.	Apr. 24, 1895.
Albert W. Dimick	Atlantic Cotton Mills	Lawrence, Mass.	Apr. 25, 1894.
Eben S. Draper	Geo. Draper & Sons	Hopedale, Mass.	Oct. 31, 1888.
George A. Draper	Geo. Draper & Sons	Hopedale, Mass.	Oct. 31, 1888.
George Otis Draper	Geo. Draper & Sons	Hopedale, Mass.	Apr. 24, 1895.
William F. Draper	Geo. Draper & Sons	Hopedale, Mass.	Jan. 17, 1867.
William F. Draper, Jr.	Geo. Draper & Sons	Hopedale, Mass.	Oct. 29, 1890.
John Drowne	Supt. Cocheco Mfg. Co.	Dover, N. H.	Apr. 29, 1896.
Joseph M. Dunham	Supt. Merrick Thread Co.	190 Walnut St., Holyoke, Mass.	Oct. 26, 1892.
David H. Dyer	Mill Engineer	7 and 8 Pocasset Bank Building, Fall River, Mass.	Oct. 18, 1871.

William A. Eastman	Supt. Lowell Hosiery Co.	Lowell, Mass.	Sept. 27, 1894.
Russell W. Eaton	Agt. Cabot Manufg. Co.	Brunswick, Me.	Oct. 26, 1887.
John Eccles	Supt. Ponemah Mills	Taftville, Conn.	Apr. 27, 1892.
D. M. Ehrlich	Treas. Galveston C. and W. Mills.	Galveston, Texas	Apr. 24, 1895.
Lawrence V. Elder		Dickinson, Texas	Oct. 27, 1886.
Frederick W. Ely	Agt. Columbian Manufg. Co.	Greenville, N. H.	Apr. 25, 1888.
H. B. Estes	Agt. Continental Mills	Lewiston, Me.	Apr. 26, 1893.
William Evans	Supt. Richard Borden Mfg. Co.	Fall River, Mass.	Apr. 29, 1896.
C. E. Falls	Sec. and Treas. Enterprise Mills	Kings Mountain, N. C.	Oct. 25, 1895.
Herbert R. Farnum	Supt. Bernon Mills	Georgiaville, R. I.	Apr. 27, 1881.
Clifton L. Field	Treas. Massaemit Yarn Mills	Shattuckville, Mass.	Apr. 25, 1894.
Frank S. Field	Supt. Massaemit Yarn Mills	Shattuckville, Mass.	Oct. 25, 1895.
William Firth	Mgr. Am. Drosophore Co.	150 Devonshire St., Boston, Mass.	Apr. 25, 1888.
Charles H. Fish	Agt. Cocheco Manufg. Co.	Dover, N. H.	Apr. 27, 1887.
Henry E. Fisher	Agt. Atlanta Cotton Mills	Atlanta, Ga.	Oct. 25, 1895.
Herbert Fisher		Taunton, Mass.	Oct. 29, 1879.
William B. Fittz	Supt. West Boylston Manufg. Co.	Oakdale, Mass.	Oct. 26, 1892.
Frederick A. Flather	Mech. Eng. Lowell Machine Shop	Lowell, Mass.	Apr. 29, 1891.
M. F. Foster	Denison Cotton Manufg. Co.	Milford, N. H.	Apr. 17, 1872.
Philip H. Fowler		Gloucester City, N. J.	Nov. 30, 1881.
C. H. Frisbie	Agt. Attawaugan Co.	Norwich, Conn.	Oct. 29, 1890.
William Gammel	Agt. Berkeley Co.	Providence, R. I.	Oct. 28, 1885.
James G. Garland		Biddeford, Me.	Oct. 29, 1879.
Richard Garsed	Wingohocking Mills, Frankford Sta.	Philadelphia, Pa.	Apr. 17, 1872.
James A. Gary	Pres. Gary Manufg. Co.	Baltimore, Md.	Apr. 25, 1883.
John Gegenheimer		Old Orchard, Me.	Apr. 30, 1890.
Charles E. Getchell	Supt. Waltham Bleachery and Dye Works,	Waltham, Mass.	Oct. 30, 1889.
Daniel Gilligan	Supt. Pocasset and Metacomet Mills	Fall River, Mass.	Apr. 29, 1896.
William C. Godfrey	Agt. Indian Orchard Mills	Indian Orchard, Mass.	Oct. 29, 1890.
Alfred M. Goodale	Treas. Boston Manufg. Co.	50 State St., Boston, Mass.	Apr. 25, 1883.
Charles J. Goodwin	Indian Orchard Mills	Indian Orchard, Mass.	Oct. 18, 1871.
Charles H. Gorton	Supt. Ballou Mill	Woonsocket, R. I.	Apr. 25, 1894.
William B. Gowdey	Mill Supplies	Box 707, Providence, R. I.	Apr. 30, 1890.
George P. Grant		186 Commonwealth Ave., Boston, Mass.	Sept. 27, 1894.
George P. Grant, Jr.	Treas. Grant Yarn Co.	Fitchburg, Mass.	Sept. 27, 1894.
D. W. Gray	Supt. Skenandoa Cotton Co.	Utica, N. Y.	Oct. 26, 1892.
R. A. Gray	Supt. Rodman Manufg. Co.	Allenton, R. I.	Apr. 24, 1895.
Stephen Greene	Mill Engineer and Architect,	131 Devonshire St., Boston, Mass.	Oct. 27, 1886.
William C. Greene	Gen. Mgr. Peacedale Manufg. Co.	Peacedale, R. I.	Oct. 27, 1886.
Joseph Warren Greene	Supt. Hamilton Web. Co.	Hamilton, R. I.	Apr. 29, 1896.
John Gregson	Supt. Merchants Manufg. Co.	Fall River, Mass.	Apr. 24, 1895.

Frederick Grinnell	Pres. Gen. Fire Extinguisher Co.	Providence, R. I.	Apr. 24, 1878.
Arthur H. Gulliver	Asst. Supt. Lonsdale Co.	Ashton, R. I.	Apr. 24, 1889.
B. F. Guy	Supt. Pelzer Manufg. Co.	Pelzer, S. C.	Apr. 24, 1895.
Frank R. Hadley	Treas. Bennett Manufg. Co.	New Bedford, Mass.	Oct. 28, 1891.
Frank J. Hale	Agt. Pettee Machine Works	Newton Upper Falls, Mass.	Apr. 27, 1892.
Samuel Hale	Treas. and Agt. Dixie Cotton Mills	La Grange, Ga.	Oct. 29, 1890.
William E. Hall	Supt. Boston Duck Co.	Bondsville, Mass.	Apr. 27, 1892.
Z. D. Hall	Gen. Mgr., B. B. & R. Knights Mills	Providence, R. I.	Oct. 29, 1879.
John H. Hambly	Treas. Quidnick Manufg. Co.	Providence, R. I.	Apr. 24, 1895.
John F. Hamlet	P. O. Box 160,	Fall River, Mass.	Oct. 31, 1888.
J. O. Hannum	Agt. Saratoga Victory Mfg. Co.	Victory Mills, Saratoga Co. N. Y.	Apr. 30, 1890.
Frank Harris	Hamlet Mills	Woonsocket, R. I.	Apr. 24, 1889.
Henry F. Harris	Treas. West Boylston Manufg. Co.	Box 282, Worcester, Mass.	Apr. 30, 1890.
John J. Hart	Supt. Merrimack Print Works	Lowell, Mass.	Apr. 24, 1895.
Frank Haskell	Agt. and Treas. Westbrook Manufg. Co.	Westbrook, Me.	Apr. 25, 1883.
A. M. Hathaway	Supt. H. N. Slater Mills	Webster, Mass.	Sept. 27, 1894.
Samuel E. Hathaway	Supt. Fall River Iron Works	Fall River, Mass.	Sept. 27, 1894.
William Hathaway	Supt. Barnard Manufg. Co.	Fall River, Mass.	Apr. 25, 1894.
William B. Hawes	Treas. No. Dighton Cotton Co.	Fall River, Mass.	Oct. 25, 1895.
Alfred Hawkesworth	Supt. Merchants Manufg. Co.	Montreal, P. Q.	Apr. 26, 1893.
Horace L. Hayden	Agt. Walhalla Cotton Mills	Walhalla, S. C.	Apr. 24, 1895.
William Hayes	Agt. Barker Mill	Auburn, Me.	Apr. 30, 1879.
W. G. Henderson	Agt. Shetucket Co.	Norwich, Conn.	Apr. 29, 1896.
James G. Hill	Supt. Lawrence Manufg. Co.	Lowell, Mass.	Jan. 15, 1868.
William R. Hill	Treas. Glasgow Manufg. Co.	S. Hadley Falls, Mass.	Oct. 25, 1893.
Geo. H. Hills	Treas. Davol Mills and Stephens Mfg. Co.	Fall River, Mass.	Oct. 25, 1895.
John H. Hines	Agt. Queen City Cotton Co.	Burlington, Vt.	Sept. 27, 1894.
Charles H. Hobbs	Agt. Thorndike Co.	Thorndike, Mass.	Apr. 28, 1886.
John Holland		Dover, N. H.	Oct. 31, 1877.
Gideon F. Holmes	Treas. Plymouth Cordage Co.	No. Plymouth, Mass.	Oct. 30, 1889.
George W. Holt	Agt. Monohansett Manufg. Co.	Putnam, Conn.	Oct. 29, 1879.
William P. Holt	Supt. Slatersville Mills	Box 315, Slatersville, R. I.	Oct. 25, 1893.
George L. Hooper	Mangr. Shaw Stocking Co.	Lowell, Mass.	Apr. 25, 1892.
John Hopkinson	Gen. Mgr. Slagden & Kuckney Woolen Mill	Stamford, Ky.	Apr. 25, 1883.
Henry S. Houghton, Jr.	Supt. Paul Whitin Manufg. Co.	Northbridge, Mass.	Apr. 24, 1895.
Elisha H. Howard	Agt. Harris Manufg. Co.	Providence, R. I.	Apr. 25, 1883.
Henry S. Howe	Lawrence & Co.	68 Chauncey St., Boston, Mass.	Oct. 31, 1877.
W. S. Hume	Supt. Pequot Mill	Montville, Conn.	Oct. 29, 1890.

Arthur W. Hunking	Agt. Mass. Mills, in Georgia	Lindale, Floyd County, Ga.,	Apr. 24, 1895.
J. E. Jenckes	Treas. E. Jenckes Co.	Pawtucket, R. I.	Apr. 24, 1895.
David L. Jewell	Agt. China, Webster & Pembroke M.	Suncook, N. H.	July 26, 1865.
David S. Johnston	Cohoes Foundry & Machine Co.	Cohoes, N. Y.	Oct. 28, 1891.
W. T. Jordan	Mgr. Mountain Island Mfg. Co.	Mountain Island, N. C.	Oct. 25, 1895.
Frank E. Kaley	Treas. Morse & Kaley Mfg. Co.	Milford, N. H.	Oct. 25, 1895.
W. E. Keach	Supt. E. Jencks Mfg. Co.	57 Harrison St., Pawtucket, R. I.	Oct. 26, 1892.
Roland R. Kelly	Supt. Williamstown Manufg Co.	Williamstown Sta., Mass.	Nov. 30, 1881.
Joseph H. Kendrick	Agt. American Supply Co.	Box 850, Providence, R. I.	Apr. 30, 1879.
George E. Kent	Agt. and Gen. Mgr. Pittsfield Mills,	Pittsfield, N. H.	Oct. 31, 1888.
Hervey Kent	Ex-Treas. Exeter Manufg. Co.	Exeter, N. H.	July 26, 1865.
William J. Kent	Agt. Wamsutta Mills	New Bedford, Mass.	Oct. 26, 1887.
Nathaniel B. Kerr	Agt. Grinnell Manufg. Co.	New Bedford, Mass.	Oct. 26, 1892.
John Kilburn		Belmont, Mass.	July 26, 1865.
Harry W. Kimball	Supt. Jewett City Mills	Jewett City, Conn.	Oct. 25, 1895.
John M. Kimball	Agt. Slatersville Mills	Slatersville, R. I.	Oct. 31, 1888.
Albert Knight	Supt. Quidnick Mills	Anthony, R. I.	Apr. 25, 1895.
Albert F. Knight	Agt. Berkshire Cotton Manufg. Co.	P. O. Box 963, Adams, Mass.	Oct. 27, 1886.
Jesse A. Knight	Supt. Harris Mfg. Co.	Phœnix, R. I.	Oct. 26, 1892.
Stephen A. Knight	Agt. Hebron Manufg. Co.	Box 820, Providence, R. I.	Oct. 21, 1868.
Walter B. Knight	Reynolds Manufg. Co.	Davisville, R. I.	Apr. 24, 1889.
Fred Lacey	Supt. Greylock Mills	North Adams, Mass.	Apr. 24, 1895.
Walter H. Langshaw	Supt. Dartmouth Mfg. Corp.	New Bedford, Mass.	Apr. 29, 1896.
Elliott Cowdin Lambert	Supt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 25, 1895.
Abbott F. Lawrence	Treas. Nemasket Mills	Box 125, Taunton, Mass.	Apr. 24, 1895.
Harold Lawton	Gen. Mgr. Warwick Mills	Centreville, R. I.	Oct. 27, 1886.
Evan Arthur Leigh	Textile Machinery	70 Kilby St., Boston, Mass.	Oct. 29, 1890.
J. Colby Lewis	Supt. Centreville Cotton Mills	Centreville, R. I.	Oct. 26, 1892.
Charles W. Lippitt	Prest. Silver Spring B. & D. Co.	Providence, R. I.	Oct. 30, 1878.
Henry F. Lippitt	Agt. Social and Manville Co's.	Providence, R. I.	Apr. 27, 1881.
Robert W. Lord	Agt. R. W. Lord & Co.	Kennebunk, Me.	Oct. 20, 1869.
Ernest Lovering	Agt. Lyman Mills	Holyoke, Mass.	Apr. 25, 1888.
Henry M. Lovering	Agt. Whittenton Manufg. Co.	Taunton, Mass.	Oct. 27, 1880.
William M. Lovering	Supt. Whittenton Manufg. Co.	Taunton, Mass.	Sept. 27, 1894.
Arthur H. Lowe	Treas. Parkhill Manufg. Co.	Fitchburg, Mass.	Oct. 30, 1889.
David Lowe	Asst. Supt. Parkhill Manufg. Co	Fitchburg, Mass.	Apr. 24, 1895.
J. S. Ludlam	Agt. Merrimack Manufg. Co.	Lowell, Mass.	Apr. 21, 1875.
William L. Lyall	Supt. J. & W. Lyall Loom and Machine Works	540 W. 23d St., New York City	Oct. 26, 1892.
Herbert Lyman	Treas. Hadley Co.	95 Milk St., Boston, Mass.	Oct. 25, 1895.
Otis G. Lynch	Supt. Enterprise Manufg. Co.	Augusta, Ga.	Oct. 25, 1895.
Alvin S. Lyon	Agt. Lowell Manufg. Co.	Lowell, Mass.	Apr. 26, 1882.

Jas. R. MacColl	Agt. Lorraine Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
Chas. L. Macomber	Agt. Nemasket Mills	Taunton, Mass.	Apr. 24, 1895.
Charles T. Main	Mill Engineer	Exchange Bldg., Boston, Mass.	Oct. 28, 1885.
Charles R. Makepeace,	Mill Engineer	Box 973, Providence, R. I.	Apr. 30, 1890.
Arthur B. Mann	Agt. U. S. Cotton Co.	Central Falls, R. I.	Apr. 25, 1894.
Charles H. Manning	Supt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
Henry F. Mansfield	Supt. Utica Steam Cotton Mills and Mohawk Valley Cotton Mills	Utica, N. Y.	Apr. 30, 1890.
Albert G. Martin	Supt. Kincaid Manufg. Co.	Box 272, Griffin, Ga.	Apr. 30, 1884.
Ira J. Martin	Supt. Bozrahville Co.	Bozrahville, Conn.	Oct. 26, 1892.
Philip A. Mathewson	Supt. Chace Mills	Box 607, Fall River, Mass.	Apr. 24, 1895.
Rufus A. Maxfield		Lowell, Mass.	Apr. 17, 1872.
Thomas Mayor	Textile Machinery	26 Olney St., Providence, R. I.	Oct. 27, 1880.
Robert McArthur	Agt. Pepperell and Laconia Cos.	Biddeford, Me.	Apr. 17, 1872.
Charles D. McDuffie	Agt. Manchester Mills	Manchester, N. H.	Apr. 21, 1869.
Fred C. McDuffie	Treas. Everett Mills and York Manufg. Co.	Box 2963 Boston, Mass.	Oct. 25, 1892.
Willliam G. McLoon	Supt. Boston Manufg. Co.	Waltham, Mass.	Apr. 27, 1892.
James H. McMullan	Agt. Saco Water Power Machine Co.	Biddeford, Me.	Apr. 21, 1869.
William P. McMullan	Agt. Naumkeag Steam Cotton Co.	Salem, Mass.	Sept. 27, 1894.
John Tempest Meats	Supt. Mason Machine Works	Taunton, Mass.	Apr. 27, 1887.
Charles H. Merriman, Jr.	Asst. Supt. Social Nourse Mills	Woonsocket, R. I.	Apr. 25, 1895.
Frank M. Messenger	Agt. Grosvenor Dale Co.	No. Grosvenor Dale, Conn.	Apr. 27, 1887.
James I. Milliken	Agt. Everett Mills	Lawrence, Mass.	Oct. 26, 1892.
Roscoe S. Milliken	Supt. Pemberton Co.	Lawrence, Mass.	Apr. 29, 1896.
A. B. Mole	Mgr. Greylock Mill	Adams, Mass.	Apr. 24, 1895.
Edward A. Mongeon	Supt. Blackstone Manufg. Co.	Blackstone, Mass.	Apr. 24, 1895.
Fred W. Moore	Agt. Cordis Mills	Millbury, Mass.	Apr. 27, 1892.
George F. Morgan	Lowell Machine Shop	Lowell, Mass.	Oct. 28, 1891.
Albert H. Morton	Supt. Kitson Machine Co.	Lowell, Mass.	Oct. 28, 1891.
Fred S. Mosher	Supt. Henrietta Mills	Henrietta, Rutherford Co., N. C.	Oct. 25, 1895.
Oliver H. Moulton	Supt. Hamilton Manufg. Co.	Lowell, Mass.	July 26, 1865.
Farquharson J. Muir	Supt. Canadian Col. Cot. Mills Co.	Hamilton, Ont., Can.	Apr. 27, 1892.
Wm. B. Munroe	Supt. Millville Manufg. Co.	Millville, N. J.	Oct. 25, 1895.
Roscius C. Newell	Supt. Palmer Mill	Three Rivers, Mass.	Oct. 25, 1895.
William G. Nichols	Supt. Glasgow Manufg. Co.	S. Hadley Falls, Mass.	Oct. 25, 1893.
Franklin Nourse	Agt. Lawrence Manufg. Co.	Lowell, Mass.	Apr. 24, 1878.
Eben H. Nutting	Agt. Hooksett Mills	Hooksett, N. H.	Oct. 25, 1882.
S. Odenheimer	Lane Mills	New Orleans, La.	Oct. 25, 1893.
Charles K. Oliver	Treas. Columbia Mills Co.	Columbia S. C.	Sept. 27, 1894.

Warren M. Orswell	Pres. Orswell Mills, Nockedge Mills and Lancaster Manufg. Co.	Fitchburg, Mass.	Apr. 16, 1873.
Oscar L. Owen	Mech. and Mill Eng. Whitin Machine Works	Whittinsville, Mass.	Apr. 25, 1894.
Elmer E. Page	Agt. York Manufg. Co.	Saco, Me.	Apr. 27, 1892.
Francis J. Parker	Treas. Monadnock Mills, 27 Kilby St.,	Boston, Mass.	Jan. 15, 1868.
O. B. Parker	Supt. U. S. Cotton Co.	Central Falls, R. I.	Apr. 24, 1895.
Samuel L. Parker	Supt. Turners Falls Mills	Turners Falls, Mass.	Apr. 29, 1896.
Walter E. Parker	Agt. Pacific Mills	Lawrence, Mass.	Apr. 25, 1877.
John H. Parks	Pres. Wm. Parks & Son, Ltd.	St. John, N. B.	Apr. 24, 1878.
John W. Pead	Supt. Merrimack Manufg. Co.	Lowell, Mass.	Apr. 26, 1893.
James R. Pearce	Supt. Fulton Bag and Cotton Mills	68 So. Boulevard, Atlanta, Ga.	Oct. 25, 1895.
Wm. C. Peirce	Pres. Elizabeth Mills, 564 Eddy St.,	Providence, R. I.	Apr. 24, 1895.
William D. Pennell	Agt. Hill Manufg. Co.	Lewiston, Me.	Apr. 16, 1873.
Haven C. Perham	Treas. Kitson Machine Co.	Lowell, Mass.	Apr. 30, 1879.
Henry C. Phillips	Supt. H. N. Slater Mills	Webster, Mass.	Apr. 25, 1894.
Andrew G. Pierce, Jr.	Treas. Pierce Manufg. Corp.	New Bedford, Mass.	Apr. 24, 1895.
Reuben Pilling, Jr.	Supt. Granite Mills Co.	Greenville, R. I.	Apr. 29, 1896.
Moses Pierce	Pres. Aspinook Co.	Jewett City, Conn.	Oct. 30, 1878.
Charles H. Plummer	Agt. Great Falls Manufg. Co.	Somersworth, N. H.	Apr. 25, 1888.
Thomas C. Powell		Providence, R. I.	Oct. 30, 1889.
Herbert L. Pratt	Agt. Bates Manufg. Co.	Lewiston, Me.	Oct. 27, 1875.
J. E. Prest	Gen. Supt. Harmony Mills	Cohoes, N. Y.	Apr. 17, 1872.
M. W. Quinn	Agt. Hamilton Woolen Co.	Amesbury, Mass.	Oct. 27, 1886.
T. G. Ramsdell	Agt. Monument Mills	Housatonic, Mass.	Oct. 30, 1878.
M. A. Rawlinson	Supt. Tremont and Suffolk Mills	Lowell, Mass.	Apr. 24, 1895.
Robert Redford	Agt. Arlington Mills	Lawrence, Mass.	Apr. 26, 1882.
James Renfrew	Treas. Renfrew Manufg. Co.	Adams, Mass.	Oct. 18, 1871.
Roscoe C. Reynolds	Agt. Lewiston Machine Co.	Lewiston, Me.	Oct. 25, 1876.
F. H. Rice	Holbrook Mills	Box 47, W. Boylston, Mass.	Apr. 29, 1880.
Charles H. Richardson	Agt. Appleton Co.	Lowell, Mass.	Apr. 24, 1889.
C. W. Rider	Treas. Merrick Thread Co.	Holyoke, Mass.	Apr. 29, 1896.
Charles E. Riley	Textile Machinery	Box 2815, 281 Congress St., Boston, Mass.	Apr. 25, 1888.
Charles D. Robinson	Supt. Crompton Co.	Crompton, R. I.	Sept. 27, 1894.
William A. Robinson	Treas. Savannah Cotton Mills	Savannah, Ga.	Apr. 29, 1896.
John K. Russell	Gen. Mgr. May's Landing Water P. Co. and Millville Mfg. Co.	Vineland, N. J.	Apr. 30, 1884.
Arnold B. Sanford	Treas. Globe Yarn Mill	Fall River, Mass.	Oct. 25, 1882.
Charles H. Savage	Supt. Manville Co.	Manville, R. I.	Apr. 26, 1893.
J. H. Sawyer	Treas. Newmarket Manufg. Co.	Box 2966, Boston, Mass.	July 26, 1865.

Geoorge H. Sayward	Mgr. Standard Yarn Co.	Oswego, N. Y.	Oct. 29, 1890.
Arnold Schaer	Supt. Warren Manufg. Co.	Warren, R. I.	Apr. 24, 1895.
John Scott	Supt. Willimantic Linen Co.	Willimantic, Conn.	Oct. 29, 1879.
George H. Shapley	Mgr. Silver Lake Co. 78 Chauncy St.,	Boston, Mass.	Apr. 29, 1896.
Frank P. Sheldon	Mill Engineer	Providence, R. I.	Apr. 25, 1894.
Thomas C. Sheldon	Agt. Fitchburg Duck Mills	Fitchburg, Mass.	Oct. 29, 1884.
Willis S. Shepard	Pres. American Net and Twine Co. 34 Commercial St.,	Boston, Mass.	Apr. 29, 1896.
George E. Sherman		Central Falls, R. I.	Apr. 27, 1881.
William F. Sherman	Agt. Atlantic Cotton Mills	Lawrence, Mass.	Apr. 15, 1874.
Charles M. Shove	Pres. Granite Mills	Box 45, Fall River, Mass.	Oct. 27, 1875.
Herbert H. Shumway	Treas. Corr Mfg. Co.	Taunton, Mass.	Apr. 24, 1895.
Francis H. Silsbee	Supt. Cotton Dept. Pacific Mills	Lawrence, Mass.	Apr. 27, 1887.
Louis Simpson	Gen. Mgr. Montreal Cotton Co.	Valleyfield, P. Q.	Apr. 24, 1895.
Abbott E. Slade	Treas. Laurel Lake Mills	Fall River, Mass.	Oct. 25, 1893.
Arba C. Slater	Supt. Linwood Mills	Whitinsville, Mass.	Jan. 15, 1868.
Arthur T. Smith	Supt. Langley Manufg. Co.	Langley, S. C.	Oct. 25, 1895.
Joel Smith	Supt. The J. P. King Mfg. Co. Supt. Aiken Manufg. Co.	Augusta, Ga. Bath, S. C.	Oct. 25, 1895.
Robert R. Smith	Mgr. Greenwoods Co.	New Hartford, Conn.	Oct. 19, 1870.
Ellison A. Smyth	Pres. Pelzer Manufg. Co.	Pelzer, S. C.	Oct. 26, 1892.
Wm. S. Southworth	Agt. Mass. Cotton Mills	Lowell, Mass.	Oct. 31, 1888.
William T. Spear	Supt. Jackson Co.	Nashua, N. H.	Oct. 30, 1889.
S. S. Spencer	Supt. Conestoga Steam Mills	Lancaster, Pa.	Oct. 25, 1876.
George E. Spofford	Asst. Supt. Natick Mill	Natick, R. I.	Apr. 29, 1896.
Leroy Springs	Pres. Lancaster Cotton Mills	Lancaster, S. C.	Oct. 25, 1895.
George R. Stearns	Pres. Riverside Mills	Augusta, Ga.	Apr. 30, 1890.
Walter F. Stiles	Treas. Nockedge & Orswell Mills	Fitchburg, Mass.	Oct. 25, 1895.
O. W. Stites	Supt. No. Pownal Mfg. Co.	No. Pownal, Vt.	Oct. 25, 1895.
Joseph Stone	Room 949, 53 State St.	Boston, Mass.	Oct. 21, 1874.
Herman F. Straw	Agt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
Walter H. Summersby	Supt. Pontiac Mill and Bleachery	Pontiac, R. I.	Oct. 25, 1893.
Albert A. Sweet	Supt. King Philip Mills, 969 Charles St.,	Fall River, Mass.	Apr. 24, 1895.
James O. Sweet	Agt. & Treas. Ashland Cotton Co.	Jewett City, Conn.	Apr. 28, 1886.
Edward P. Taft	Treas. Ponemah Mills	Providence, R. I.	Oct. 28, 1885.
Robert Rennie Taft	Supt. Baltic Power Co.	Baltic, Conn.	Apr. 24, 1895.
Robert W. Taft	Treas. Coventry Co. Box 1144,	Providence, R. I.	Sept. 27, 1894.
George P. Taylor	Supt. Lancaster Mills	Clinton, Mass.	Apr. 25, 1877.
James W. Taylor	Supt. Canoe River Mills	Taunton Mass.	Oct. 26, 1892.
Richard Thackeray	Supt. Weetamoe Mills	Fall River, Mass.	Apr. 29, 1885.
Earl A. Thissell	Amasa Pratt & Co.	Lowell, Mass.	Oct. 30, 1878.
Ariel C. Thomas	Supt. Clinton Manufg. Co.	Woonsocket, R. I.	Oct. 31, 1888.
Charles E. Thomas	Treas. Forestdale Manufg. Co.	Woonsocket, R. I.	Oct. 31, 1883.
Edward W. Thomas	Agt. Tremont and Suffolk Mills	Lowell, Mass.	Apr. 30, 1884.

Ralph E. Thompson	Supt. Parkill Manufg. Co.	Fitchburg, Mass.	Apr. 25, 1894.
D. M. Thompson	Pres. & Treas. Corliss Steam Engine Co.	Providence, R. I.	Oct. 28, 1885.
Osmon B. Tilton	Supt. Exposition Cotton Mills	22 Howard St., Atlanta, Ga.	Oct. 27, 1886.
James P. Tolman	Pres. Samson Cordage Works	115 Congress St., Boston, Mass.	Oct. 29, 1890.
D. A. Tompkins	Pres. Chester & Patawba Mills	Charlotte, N. C.	Oct. 25, 1895.
George W. Towne	Supt. Arlington Mills	Lawrence, Mass.	Oct. 26, 1892.
William E. Trainer	Pres. Linwood Mills	Trainer, Penn.	Apr. 21, 1875.
Robert B. Treat	Centerville Cotton Mill	Centerville, R. I.	Sept. 27, 1894.
C. H. Truesdell	Supt. Attawaugan Co.	Dayville, Conn.	Apr. 29, 1896.
Edmund E. Truesdell	Supt. China, Webs'r & Pemb'ke Mills	Suncook, N. H.	Apr. 26, 1876.
Oscar B. Truesdell	Agt. Fiskdale Mills	Fiskdale, Mass.	Apr. 24, 1895.
George E. Tucker	Agt. Otis Co.	Ware, Mass.	Oct. 25, 1895.
William D. Twiss	Supt. Everett Mills	Lawrence, Mass.	April 29, 1896.
Frank P. Vogl	Agt. Monadnock Mills	Claremont, N. H.	Sept. 27, 1894.
Jude C. Wadleigh	Supt. Mass. Cotton Mills	Lowell, Mass.	Oct. 26, 1892.
H. E. Walmesley	Supt. Clark Thread Co.	Newark, N. J.	Oct. 29, 1890.
James A. Walsh	Agt. Lewiston Bleachery and Dye Works	Lewiston, Me.	Apr. 27, 1892.
James Waring	Treas. Narragansett Mills	Fall River, Mass.	Oct. 27, 1875.
Arthur W. Warren	Treas. W. Warren Thread Works	Westfield, Mass.	Apr. 29, 1896.
John Waterman	Treas. Warren Manufg. Co.	Warren, R. I.	Apr. 30, 1884.
Joseph W. Wattles	Manufacturers' Supplies	Canton Junction, Mass.	July 26, 1865.
T. B. Wattles	Mangr. Boscawen Mills	Penacook, N. H.	July 26, 1865.
George W. Weeks	Agt. Lancaster Mills	Clinton, Mass.	Apr. 21, 1869.
W. B. Smith Whaley	Mill Engineer	Columbia, S. C.	Apr. 24, 1895.
H. D. Wheat	Treas. Gaffney Manufg. Co. and Tucapau Mills	Gaffney, S. C.	Apr. 24, 1895.
Channing Whitaker	Mill Eng. Lowell Machine Shop	Lowell, Mass.	Oct. 15, 1873.
A. Tenny White	Supt. Globe Mill	Woonsocket, R. I.	Oct. 26, 1887.
Arthur F. Whitin	Pres. Saunders Cotton Mills; Agt. Whitinsville Cotton Mills	Whitinsville, Mass.	Apr. 24, 1895.
Henry T. Whitin	Treas Paul Whitin Manufg. Co.	Northbridge, Mass.	Apr. 25, 1877.
Alfred N. Whiting	Treas. L. M. Harris Manufg. Co.	Oakdale, Mass.	Apr. 21, 1875.
William S. Whitney	Supt. Mech. Dept., Wash. Mills Co.	Lawrence, Mass.	Apr. 24, 1878.
William Whittam, Jr.	Gen. Agt. Jas. Chadwick & Bro., Ltd.	31 Danforth Ave., Jersey City, N. J.	Apr. 26, 1893.
George F. Whitten	Agt. Amory Mfg. Co.	Manchester, N. H.	Oct. 26, 1892.
Edward B. Wilbur	Supt. Newberry Cotton Mills	Newberry, S. C.	Oct. 30, 1889.
Henry M. Wilcox	Treas. John Rhodes Warp Co.	Millbury, Mass.	Apr. 24, 1889.
Eben C. Willey	Supt. Mauchaug Company	Mauchaug, Mass.	Apr. 29, 1896.
Theop. W. Wilmarth	Supt. Millbury Cotton Mills	Millbury, Mass.	Oct. 31, 1883
Thomas Wilmarth	Supt. Saunders Cotton Mills	Saundersville, Mass.	Apr. 21, 1875

J. P. Wilson	Treas. Dover Yarn Mills	Charlotte, N. C.	Oct. 25, 1895.
A. S. Winslow	Agt. Peabody Co.	Newburyport, Mass.	Oct. 31, 1888.
George Wood	Pres. Millville Manufg. Co.	Box 1277, Phila., Pa.	Oct. 16, 1872.
C. J. H. Woodbury	Secy. and Treas.	Lynn, Mass.	Oct. 29, 1879.
Alvin Woodman	32 Wilder St.	Brockton, Mass.	Apr. 26, 1893.
A. A. Young, Jr.	Treas. Jewett City Mills	Jewett City, Conn.	Sept. 27, 1894.
Adelbert R. Young	Supt. Ashland Cotton Co.	Jewett City, Conn.	Apr. 25, 1894.

ASSOCIATE MEMBERS.

Wm. Emmett Anderson	Eng. and Mgr. Standard Circular Cotton Co., Ltd.	Little Rock, Ark.	Oct. 25, 1895.
G. M. Angier	Agt. Eddy Electric Co.	64 Federal St., Boston, Mass.	Apr. 24, 1895.
Geo. R. Babbitt	Pres. American Oil Co.	182 So. Water St., Providence, R. I.	Apr. 24, 1895.
D. C. Ball	Pres. Amer. Cot. Bale Imp'ment Co.	St. Louis, Mo.	Oct. 25, 1895.
Geo. S. Barnum	Secy. and Treas. The Bigelow Co.	New Haven, Conn.	Apr. 24, 1895.
Colin C. Bell	Pres. and Treas. Laminar Fibre Co.	No. Cambridge, Mass.	Apr. 29, 1896.
Geo. W. Benson	Dealer in Cotton Waste. A. Emerson & Co.	36 Purchase St., Boston, Mass.	Apr. 24, 1895.
William H. Bent	Treas. Mason Machine Works	Taunton, Mass.	Apr. 29, 1896.
W. T. Bessonette	Sec. Temple Gin and Compress Co., and Inventor of Cylindrical Ball and Roller Compress,	Temple, Texas.	Apr. 29, 1896.
C. H. Botsford	2d Vice-Pres. Amer. Cot. Bale Imp. Co.	Waco, Texas	Oct. 25, 1895.
J. Payson Bradley	The Kehew-Bradley Co.	24 Purchase St., Boston, Mass.	Apr. 24, 1895.
D. Russell Brown	Brown Bros. Co.	Providence, R. I.	Apr. 24, 1895.
H. Martin Brown	Brown Bros. Co.	Providence, R. I.	Apr. 24, 1895.
John H. Burghardt	Mill Supplies	31 Pearl St., Boston, Mass.	Apr. 24, 1895.
Eugene E. Burnham	Leather Belting Manufg. Co.	168 Broadway, Lawrence, Mass.	Oct. 25, 1895.
James Butterworth	Pres. H. W. Butterworth & Sons	York and Cedar Sta., Philadelphia, Pa.	Apr. 24, 1895.
Malcolm Campbell	Woonsocket Machine and Press Co.	Woonsocket, R. I.	Apr. 24, 1895.
W. W. Carey	Wood Machinery Builder	Lowell, Mass.	Apr. 24, 1895.
Fred A. Chase	Mill Supplies, F. A. Chase & Co.	Providence, R. I.	Apr. 24, 1895.
Chas. H. Child	Treas. Brown Bros. Co.	Box 890, Providence, R. I.	Apr. 24, 1895.
Peter H. Corr	Cotton and Cotton Yarns	Taunton, Mass.	Apr. 24, 1895.
Thos. G. Cox	Selling Agt. Mason Mach. Works	Box 316, Taunton, Mass.	Apr. 24, 1895.
Frederick I. Dana	Mech. Eng. Thomas Phillips Co.	Providence, R. I.	Apr. 25, 1895.
J. F. Dickinson	Treas. So. Belting Co.	Atlanta, Ga.	Apr. 29, 1896.
R. H. Deming	Cotton Merchant	10 So. Water St., Providence, R. I.	Apr. 24, 1895.
C. E. W. Dow	Agt. Metallic Roll Co.	Indian Orchard, Mass.	Apr. 24, 1895.

G. B. Emmons	Pres. Emmons Loom Harness Co.	Box 203, Lawrence, Mass.	Oct. 25, 1895.
T. C. Entwistle	Cotton Machinery Mfr.	Lowell, Mass.	Apr. 24, 1895.
D. D. Felton	Treas. S. A. Felton & Sons Co.	Manchester, N. H.	Apr. 24, 1895.
John W. Ferguson	Mill Engineer and Builder	Paterson, N. J.	Apr. 24, 1895.
J. Herbert Foster	Cotton Broker	Providence, R. I.	Apr. 24, 1895.
Geo. A. Fuller	Mgr. Amer. Card Clothing Co.	Providence, R. I.	Apr. 24, 1895.
H. P. Garland	Treas. Loom Picker Co.	Biddeford, Me.	Oct. 25, 1895.
Allan V. Garratt	Chief Eng. Lombard Water Wheel Gov. Co.	61 Hampshire St., Boston, Mass.	Apr. 24, 1895.
Royal W. Gates	Joshua Gates & Sons, Belting	Lowell, Mass.	Apr. 24, 1895.
W. S. Granger	Prest. Granger Foundry & Machine Co.,	Providence, R. I.	Apr. 24, 1895.
William L. Haines	Agt. for Brooks & Doxey, of Manchester, Eng.	161 Pearl St., Boston, Mass.	Apr. 29, 1896.
A. Walter Harris	Treas. A. W. Harris Oil Co.	326 So. Water St., Providence, R. I.	Oct. 25, 1895.
John H. Haworth	Haworth & Watson Mfrs. Paper Tubes for Textile Manufg.	Lowell, Mass.	Oct. 25, 1895.
Jerome Hill	Pres. Jerome Hill Cotton Co.	116 South Main St., St. Louis, Mo.	Apr. 29, 1896.
Henry A. Holcomb	Treas. New Bedford Boiler Co.	New Bedford, Mass.	Oct. 25, 1895.
C. H. Hutchins	Pres. and Treas. Knowles Loom Works,	Worcester, Mass.	Oct. 25, 1895.
David Jackson	Pres. & Mgr. Jackson Pat. Shell Roll Co.	Pawtucket, R. I.	Apr. 25, 1895.
Wm. B. Kehew	The Kehew-Bradley Co.	24 Purchase St., Boston, Mass.	Apr. 24, 1895.
Josiah M. Lasell	Asst. Treas. Whitin Machine Works,	Whitinsville, Mass.	Apr. 24, 1895.
Stephen C. Lowe	Mill Supplies	New Bedford, Mass.	Oct. 25, 1895.
F. H. Maynard	Bus. Mgr. Gen. Fire Extinguisher Co.,	Providence, R. I.	Apr. 24, 1895.
Geo. H. Meader	Steam Appliances	165 High St., Boston, Mass.	Apr. 24, 1895.
Geo. B. Morison	Selling Agt. Hadley Co.	95 Milk St., Boston, Mass.	Apr. 24, 1895.
Sidney B. Paine	Electrical Engineer	180 Summer St., Boston, Mass.	Apr. 24, 1895.
Geo. C. Phillips	Treas. Thomas. Phillips Co.	Providence, R. I.	Apr. 24, 1895.
Stephen Minot Pitman	Sec'y Narragansett Fire Ins. Co.,	Box 315, Providence, R. I.	Apr. 25, 1895.
Charles F. Randall	Expert in Textiles	Equitable Bld., Boston, Mass.	Apr. 25, 1895.
R. H. Rice	Treas. Rice & Sargent Steam Eng. Co.	40 Codding St., Providence, R. I.	Apr. 24, 1895.
C. E. Roberts	Mangr. Hartford St. Boiler Imp. & Inspection Co.	125 Milk St., Boston, Mass.	Apr. 24, 1895.
John M. Russell	Cashier Knowles Loom Works	Worcester, Mass.	Oct. 25, 1895.

E. A. Smith	Pres. Charlotte Supply Co.	Charlotte, N. C.	Oct. 25, 1895.
Lewis R. Speare	Alden Speare Sons & Co., Oil and Mill Supplies	369 Atlantic Ave., Boston, Mass.	Oct. 25, 1895.
Henry C. Spence	Gen. Mgr. Metallic Drawing Roll Co.	Indian Orchard, Mass.	Apr. 24, 1895.
Geo. W. Stafford	Mgr. Knowles Loom Works	Providence, R. I.	Apr. 25, 1895.
Daniel J. Sully	Cotton Broker	Providence, R. I.	Apr. 24, 1895.
Cyrus A. Taft	Whitin Machine Works	Whitinsville, Mass.	Apr. 24, 1895.
Winthrop Thayer	Mgr. Babcock & Wilcox Co., 8 Oliver St.,	Boston, Mass.	Apr. 29, 1896.
G. A. Thudium	Victoria Size	Malden, Mass.	Apr. 24, 1895.
Wm. V. Threlfall	Selling Agt. Pettee Machine Works	Newton Upper Falls, Mass.	Apr. 24, 1895.
Frank H. Underwood	Mgr. Dodge Mfg. Co., 137 Purchase St.,	Boston, Mass.	Apr. 29, 1896.
Justin A. Ware	Secy. and Treas. Crompton Loom Wks.	Worcester, Mass.	Oct. 25, 1895.
Walter S. Watson	Haworth & Watson Mfrs. Paper Tubes for Textile Manufg.	Lowell, Mass.	Oct. 25, 1895.
G. Marston Whitin	Treas. Whitin Machine Works	Whitinsville, Mass.	Apr. 24, 1895.
Erving Y. Woolley	Stoddard, Haserick, Richards & Co.	152 Congress St., Boston, Mass.	Apr. 24, 1895.

Honorary Members	2
Active Members	378
Associate Members	70
Total Membership	450

MEMBERS OF THE ASSOCIATION,

May 1, 1896.

ARRANGED BY STATES.

MAINE.

Auburn	William Hayes	Barker Mill.
Biddeford	James G. Garland	
Biddeford	H. P. Garland	Loom Picker Co.
Biddeford	Robert McArthur	Pepperell & Laconia Cos.
Biddeford	Jas. H. McMullan	Saco Water Power Machine Co.
Brunswick	Russell W. Eaton	Cabot Manufg. Co.
Kennebunk	Robert W. Lord	R. W. Lord & Co.
Lewiston	A. D. Barker	Avon Manufg. Co.
Lewiston	George W. Bean	Androscoggin Mills.
Lewiston	H. B. Estes	Continental Mills.
Lewiston	William D. Pennell	Hill Manufg. Co.
Lewiston	Herbert L. Pratt	Bates Manufg. Co.
Lewiston	Roscoe C. Reynolds	Lewiston Machine Co.
Lewiston	James A. Walsh	Lewiston Bleachery and Dye Works.
Old Orchard	John Gegenheimer	
Saco	Elmer E. Page	York Manufg. Co.
Waterville	Stephen I. Abbot	Lockwood Co.
Westbrook	Woodbury K. Dana	Dana Warp Mills.
Westbrook	Frank Haskell	Westbrook Manufg. Co.

NEW HAMPSHIRE.

Claremont	Frank P. Vogl	Monadnock Mills.
Dover	Charles H. Fish	Cocheco Manufg. Co.
Dover	John Drowne	Cocheco Manufg. Co.
Dover	John Holland	

Exeter	Hervey Kent	Exeter Manufg. Co.
Greenville	Frederick W. Ely	Columbian Manufg. Co.
Hooksett	Eben H. Nutting	Hooksett Mills.
Manchester	Stephen N. Bourne	Stark Mills.
Manchester	George A. Clark	Manchester Mills.
Manchester	D. D. Felton	S. A. Felton & Sons Co.
Manchester	Elliott Cowdin Lambert	Amoskeag Manufg. Co.
Manchester	Charles H. Manning	Amoskeag Manufg. Co.
Manchester	Charles D. McDuffie	Manchester Mills.
Manchester	Herman F. Straw	Amoskeag Manufg. Co.
Manchester	George F. Whitten	Amory Manufg. Co.
Milford	M. F. Foster	Denison Cotton Manufg. Co.
Milford	Frank E. Kaley	Morse & Kaley Manufg. Co.
Nashua	William D. Cadwell	Nashua and Jackson Cos.
Nashua	William T. Spear	Jackson Co.
Penacook	T. B. Wattles	Boscawen Mills.
Pittsfield	George E. Kent	Pittsfield Mills.
Salmon Falls	O. S. Brown	Salmon Falls Manufg. Co.
Somersworth	Charles H. Plummer	Great Falls Manufg. Co.
Suncook	David L. Jewell	China, Webster & Pembroke Mills.
Suncook	Edmund E. Truesdell	China, Webster & Pembroke Mills.

VERMONT.

Burlington	John H. Hines	Queen City Cotton Co.
No. Pownal	O. W. Stites	No. Pownal Manufg. Co.

MASSACHUSETTS.

Adams	John S. Adams, Jr.	Adams Bros. Manufg. Co.
Adams	Albert F. Knight	Berkshire Cotton Mfg. Co., Box 963.
Adams	A. B. Mole	Greylock Mills.
Adams	James Renfrew	Renfrew Manufg. Co.
Amesbury	M. W. Quinn	Hamilton Woollen Co.
Belmont	John Kilburn	
Blackstone	Edward A. Mongeon	Blackstone Manufg. Co.
Bondsville	Wm. E. Hall	Boston Duck Co.
Bondsville	Elmer G. Childs	Boston Duck Co.
Boston	Charles B. Amory	Hamilton Manufg. Co.
Boston	G. M. Angier	Eddy Electric Manufg. Co., 64 Federal St.
Boston	Edward Atkinson	Boston Mfrs. Mut. Fire Ins. Co.
Boston	Edward W. Atkinson	Stoddard, Haserick, Richards & Co., 150 Congress St.
Boston	Geo. W. Benson	Dealer in Cotton Waste, A. Emerson & Co., 36 Purchase St.

Boston	J. Payson Bradley	The Kehew-Bradley Co., 24 Purchase St.
Boston	John H. Burkhardt	Mill Supplies, 31 Pearl St.
Boston	Alphonse S. Covel	Tremont & Suffolk Mills, Box 1716.
Boston	George Dexter	Pepperell & Laconia Cos.
Boston	Ambrose Eastman	53 State St.
Boston	William Firth	American Drosophore Co., 150 Devonshire St.
Boston	Allan V. Garratt	Lombard Water Wheel Gov. Co., 61 Hampshire St.
Boston	Alfred M. Goodale	Boston Manufg. Co., 50 State St.
Boston	George P. Grant	186 Commonwealth Ave.
Boston	Stephen Greene	Mill Engineer, 131 Devonshire St.
Boston	William L. Haines	Brooks & Doxey, Manchester, Eng., 161 Pearl St.
Boston	Henry S. Howe	Lawrence & Co., 68 Chauncy St.
Boston	William B. Kehew	The Kehew-Bradley Co., 24 Purchase St.
Boston	Evan Arthur Leigh	Textile Machinery, 70 Kilby St.
Boston	Herbert Lyman	Hadley Co., 95 Milk St.
Boston	Charles T. Main	Mill Engineer, Exchange Bldg.
Boston	Fred C. McDuffie	Everett Mills & York Manufg. Co., Box 2963.
Boston	George H. Meader	Steam Appliances.
Boston	George B. Morison	Hadley Co., 95 Milk St.
Boston	Sidney B. Paine	General Electric Co., 180 Summer St.
Boston	Francis J. Parker	Monadnock Mills, 27 Kilby St.
Boston	Charles F. Randall	Expert in Textiles, 728 Equitable Bld.
Boston	Charles E. Riley	Textile Machinery, Box 2815.
Boston	C. E. Roberts	Hartford St. Boiler Insp. & Ins. Co.
Boston	J. H. Sawyer	Newmarket Manufg. Co., Box 2966.
Boston	Geo. H. Shapley	Silver Lake Co., 78 Chauncy St.
Boston	Willis S. Shepard	Am. Net & Twine Co.
Boston	Lewis R. Speare	Mill Supplies, 369 Atlantic Ave.
Boston	Joseph Stone	53 State St., Room 949.
Boston	Winthrop Thayer	Babcock & Wilcox Co., 8 Oliver St.
Boston	James P. Tolman	Samson Cordage Works, 115 Congress St.
Boston	Frank H. Underwood	Dodge Manufg. Co., 137 Purchase St.
Boston	Erving Y. Wooley	152 Congress St.
Brockton	Alvin Woodman	32 Wilder St.
Canton Junction	Joseph W. Wattles	Manufacturers' Supplies.
Chicopee Falls	Henry A. Bailey	Chicopee Manufg. Co.
Clinton	George P. Taylor	Lancaster Mills.
Clinton	George W. Weeks	Lancaster Mills.
Fall River	F. S. Akin	Cornell Mills.

Fall River	Nathaniel B. Borden	Barnard Manufg. Co.
Fall River	Richard B. Borden	Treas. Troy C. & W. Manufg. Co.
Fall River	Thomas J. Borden	Pres. Richard Borden Manufg. Co., Box 18.
Fall River	George A. Chace	Bourne Mills.
Fall River	Simeon B. Chase	King Phillip Mills.
Fall River	John A. Collins, 73 Cottage St.,	Am. Linen Co.
Fall River	B. D. Davol	P. O. Box 418.
Fall River	David H. Dyer	Mill Eng., 7 Pocasset Bank Bldg.
Fall River	William Evans	Richard Borden Manufg. Co.
Fall River	Daniel Gilligan	Pocasset & Metacomet Mills.
Fall River	John Gregson	Merchants Mfg. Co.
Fall River	William Hathaway	Barnard Mfg. Co.
Fall River	Samuel E. Hathaway	Fall River Iron Works.
Fall River	John F. Hamlet	P. O. Box 166.
Fall River	William B. Hawes	North Dighton Cotton Co.
Fall River	George H. Hills	Davol Mills.
Fall River	Philip A. Mathewson	Chace Mills, Box 607.
Fall River	Arnold B. Sanford	Globe Yarn Mill.
Fall River	Charles M. Shove	Granite Mills, Box 45.
Fall River	Abbott E. Slade	Laurel Lake Mills.
Fall River	Albert A. Sweet	King Philip Mills, 969 Charles St.
Fall River	Richard Thackeray	Weetamoe Mills.
Fall River	James Waring	Narragansett Mills.
Fiskdale	Oscar B. Truesdell	Fiskdale Mills.
Fitchburg	George P. Grant, Jr.	Grant Yarn Co.
Fitchburg	Arthur H. Lowe	Parkhill Manufg Co.
Fitchburg	David Lowe	Parkhill Manufg. Co.
Fitchburg	Warren M. Orswell	Orswell and Nockedge Mills.
Fitchburg	Thomas C. Sheldon	Fitchburg Duck Mills.
Fitchburg	Walter F. Stiles	Nockedge & Ormswell Mills.
Fitchburg	Ralph E. Thomson	Parkhill Manufg. Co.
Griswoldville	James C. Deane	Griswoldville Manufg. Co.
Holyoke	Joseph M. Dunham	Merrick Thread Co.
Holyoke	Ernest Lovering	Lyman Mills.
Holyoke	C. W. Rider	Merrick Thread Co.
Hopedale	Eben S. Draper	Geo. Draper & Sons.
Hopedale	George A. Draper	Geo. Draper & Sons.
Hopedale	George Otis Draper	Geo. Draper & Sons.
Hopedale	William F. Draper	Geo. Draper & Sons.
Hopedale	William F. Draper, Jr.	Geo. Draper & Sons.
Housatonic	T. G. Ramsdell	Monument Mills.
Indian Orchard	William C. Godfrey	Indian Orchard Mills.
Indian Orchard	Charles J. Goodwin	Indian Orchard Mills.
Indian Orchard	Henry C. Spence	Metallic Roll Drawing Co.
Indian Orchard	C. E. W. Dow	Metallic Roll Drawing Co.

Lawrence	Wm. A. Barrell	Lawrence Duck Co.
Lawrence	Eugene E. Burnham	Leather Belting Manufg. Co., 168 Broadway.
Lawrence	F. E. Clarke	Pemberton Co.
Lawrence	Albert W. Dimick	Atlantic Cotton Mills.
Lawrence	G. B. Emmons	Emmons Loom Harness Co., Box 203
Lawrence	James I. Milliken	Everett Mills.
Lawrence	Roscoe S. Milliken	Pemberton Co.
Lawrence	Walter E. Parker	Pacific Mills.
Lawrence	Robert Redford	Arlington Mills.
Lawrence	William F. Sherman	Atlantic Cotton Mills.
Lawrence	George W. Towne	Arlington Mills.
Lawrence	William D. Twiss	Everett Mills.
Lawrence	Francis H. Silsbee	Pacific Mills.
Lawrence	William S. Whitney	Washington Mills Co.
Leicester	Chas. A. Denny	American Card Clothing Co.
Lowell	George E. Ames	Lawrence Manufg. Co.
Lowell	Edward N. Burke	Lowell Machine Shop.
Lowell	W. W. Carey	Wood Machinery Builder.
Lowell	Clarence N. Childs	Supt. Hamilton Manufg. Co.
Lowell	Jeremiah Clark	277 Dutton St., Textile Machinery.
Lowell	Alfred Clarke	Eastern Elec. Light & Stor. Bat. Co.
Lowell	Alonzo A. Coburn	Whitehead Machine Co.
Lowell	A. G. Cumnock	Boott Cotton Mills.
Lowell	Albert W. Danforth	881 Bridge St.
Lowell	Edward P. Dennis	Lowell Machine Shop.
Lowell	William A. Eastman	Lowell Hosiery Co.
Lowell	T. C. Entwistle	Manfr. Cotton Machinery.
Lowell	Frederick A. Flather	Lowell Machine Shop.
Lowell	Royal W. Gates	Joshua Gates & Sons.
Lowell	John J. Hart	Merrimac Print Works.
Lowell	John H. Haworth	Haworth & Watson Manufg. Co.
Lowell	James G. Hill	Lawrence Manufg. Co.
Lowell	George L. Hooper	Shaw Stocking Co.
Lowell	J. S. Ludlam	Merrimac Manufg. Co.
Lowell	Alvin S. Lyon	Lowell Manufg. Co.
Lowell	Rufus A. Maxfield	
Lowell	Geo. F. Morgan	Lowell Machine Shop.
Lowell	Albert H. Morton	Kitson Machine Co.
Lowell	Oliver H. Moulton	Hamilton Manufg. Co.
Lowell	Franklin Nourse	Lawrence Manufg. Co.
Lowell	John W. Pead	Merrimac Manufg. Co.
Lowell	Haven C. Perham	Kitson Machine Co.
Lowell	M. A. Rawlinson	Tremont & Suffolk Mills.
Lowell	C. H. Richardson	Appleton Co.
Lowell	Wm. S. Southworth	Mass. Cotton Mills.

Lowell	Earl A. Thissell	Amasa Pratt & Co.
Lowell	Ed. W. Thomas	Tremont & Suffolk Mills.
Lowell	Jude C. Wadleigh	Mass. Cotton Mills.
Lowell	Walter S. Watson	Haworth & Watson Mfg. Co.
Lowell	Channing Whitaker	Lowell Machine Shop.
Lynn	C. J. H. Woodbury	Secy. and Treas.
Malden	G. A. Thudium	Victoria Size.
Manchaug	Eben C. Willey	Manchaug Co.
Methuen	Lewis E. Barnes	Methuen Co.
Millbury	Fred W. Moore	Cordis Mills.
Millbury	Henry M. Wilcox	John Rhodes Warp Co.
Millbury	Theop. W. Wilmarth	Millbury Cotton Mill.
New Bedford	George A. Ayer	City Manufg. Corp.
New Bedford	Robert Burgess	Supt. Pierce Manufg. Corp.
New Bedford	Byron F. Card	New Bedford Manufg. Co.
New Bedford	Chas. C. Diman	Whitman Mills.
New Bedford	P. Y. DeNormandie	Potomska Mills.
New Bedford	Frank R. Hadley	Bennett Manufg. Co.
New Bedford	Henry A. Holcomb	New Bedford Boiler Co.
New Bedford	William J. Kent	Wamsutta Mills.
New Bedford	Nathaniel B. Kerr	Grinnell Manufg. Co.
New Bedford	Walter H. Langshaw	Dartmouth Manufg. Corp.
New Bedford	Stephen C. Lowe	Mill Supplies.
New Bedford	Andrew G. Pierce, Jr.	Pierce Manufg. Corp.
Newburyport	A. S. Winslow	Peabody Co.
Newton	Jos. P. Battles	Nonantum Worsted Co.
Newton	Josiah G. Coburn	
Newton Upper Falls	Frank J. Hale	Pette Machine Works.
Newton Upper Falls	William B. Threlfall	Pette Machine Works.
North Adams	Chas. W. Dennett	Johnson Manufg. Co.
North Adams	Fred Lacey	Greylock Mills.
Northbridge	Henry S. Houghton Jr.	Paul Whitin Manufg. Co.
Northbridge	Henry T. Whitin	Paul Whitin Manufg. Co.
North Cambridge	Colin C. Bell	Laminar Fibre Co.
North Oxford	Edwin N. Bartlett	Sigourney Mill.
North Plymouth	Gideon F. Holmes	Plymouth Cordage Co.
Oakdale	William B. Fittz	W. Boylston Manufg. Co.
Oakdale	Alfred N. Whiting	L. M. Harris Manufg. Co.
Salem	William P. McMullen	Naunkeag Steam Cotton Co.
Saundersville	Thomas Wilmarth	Saunders Cotton Co.
Shattuckville	Clifton L. Field	Massaemit Yarn Mills.
Shattuckville	Frank S. Fields	Massaemit Yarn Mills.
South Hadley Falls	William R. Hill	Glasgow Manufg. Co.
South Hadley Falls	William G. Nichols	Glasgow Manufg. Co.
Taunton	Wm. H. Bent	Mason Machine Works.
Taunton	John J. Connell	Cohannet Mills.

Taunton	Peter H. Corr	Cotton & Cotton Yarns.
Taunton	Thos. G. Cox	Mason Machine Works, Box 316.
Taunton	Herbert Fisher	
Taunton	Abbott F. Lawrence	Nemasket Mills, Box 125.
Taunton	Henry M. Lovering	Whittenton Manufg. Co.
Taunton	William M. Lovering	Whittenton Manufg. Co.
Taunton	Chas. L. Macomber	Nemasket Mills.
Taunton	Herbert H. Shumway	Carr Manufg. Co.
Taunton	John Tempest Meats	Tempest Machine Works.
Taunton	Jas. W. Taylor	Canoe River Mills.
Thorndike	Charles H. Hobbs	Thorndike Co.
Three Rivers	Roscius C. Newell	Palmer Mills.
Turners Falls	Samuel L. Parker	Turners Falls Mills.
Waltham	Chas. L. Bailey	Boston Manufg. Co.
Waltham	Chas. E. Getchell	Waltham Bleachery and Dye Works.
Waltham	William G. McLoon	Boston Manufg. Co.
Ware	George E. Tucker	Otis Co.
Webster	A. M. Hathaway	H. N. Slater Mills.
Webster	Henry C. Phillps	H. N. Slater Mills.
West Boylston	F. H. Rice	Holbrook Mills, Box 47.
Westfield	Arthur W. Warren	W. Warren Thread Works.
West Warren	John W. Brown	Warren Cotton Mills.
Whitinsville	Alfred E. Adams	Whitinsville Cotton Mills.
Whitinsville	Josiah M. Lasell	The Whitin Machine Works.
Whitinsville	Oscar L. Owen	Whitin Machine Works.
Whitinsville	Arba C. Slater	Linwood Mills.
Whitinsville	Cyrus A. Taft	Whitinsville Machine Works.
Whitinsville	Arthur F. Whitin	Saunders C. Mills & Whitinsville C. Mills.
Whitinsville	G. Marston Whitin	The Whitinsville Machine Works.
Wilkinsonville	E. E. Clark	Sutton Manufg. Co.
Williamstown Sta.	Roland R. Kelly	Williamstown Manufg. Co.
Worcester	Henry F. Harris	W. Boylston Manufg. Co., Box 282.
Worcester	C. H. Hutchins	Knowles Loom Works.
Worcester	John M. Russell	Knowles Loom Works.
Worcester	Justin A. Ware	Crompton Loom Works.

RHODE ISLAND.

Albion	Andrew J. Currier	Albion Mills.
Allenton	R. A. Gray	Rodman Manufg. Co.
Anthony	Albert Knight	Quidnick Mills.
Ashton	Arthur H. Gulliver	Lonsdale Co.
Central Falls	Stephen L. Adams	Stafford Manufg. Co.
Central Falls	Abel T. Atherton	A. T. Atherton Machine Co., 108 Clay St.

Central Falls	Arthur B. Mann	U. S. Cotton Co.
Central Falls	O. B. Parker	U. S. Cotton Co.
Central Falls	George E. Sherman	
Centreville	Harold Lawton	Warwick Mills.
Centerville	J. Colby Lewis	Centreville Cotton Co.
Centerville	Robert B. Treat	Centreville Cotton Mills.
Crompton	Charles D. Robinson	Crompton Co.
Davisville	Walter B. Knight	Reynolds Manufg. Co.
Georgiaville	Herbert R. Farnum	Bernon Mills.
Greenville	Reuben Pilling, Jr.	The Granite Mills Co.
Hamilton	Joseph Warren Greene	Hamilton Webb Co.
Manville	Charles H. Savage	Manville Co.
Natick	George E. Spofford	Natick Mill.
Pawtucket	William P. Dempsey	Dempsey Bleachery & Dye Works.
Pawtucket	David Jackson	Jackson Pat. Shell Roll Co.
Pawtucket	J. E. Jenckes	The E. Jencks Manufg. Co.
Pawtucket	W. E. Keach	57 Harrison St., E. Jenks Manufg. Co.
Pawtucket	Jas. R. MacColl	Lorraine Manufg. Co.
Peacedale	William C. Greene	Peacedale Manufg. Co.
Phoenix	Jesse A. Knight	Harris Manufg. Co.
Pontiac	W. H. Summersby	Pontiac Mill and Bleachery.
Providence	Charles T. Aldrich	Aldrich Manufg. Co., Box 34.
Providence	William Ames	Fletcher Manufg. Co.
Providence	George R. Babbitt	American Oil Co., 182 So. Water St.
Providence	Truman Beckwith	Dyerville Manufg. Co., Box 171.
Providence	D. Russell Brown	Brown Bros. Co.
Providence	H. Martin Brown	Brown Bros. Co.
Providence	E. C. Bucklin	Treas. Harris Manufg. Co. and Interlaken Mills, Box 289.
Providence	Fred A. Chase	Mill Supplies, F. A. Chase & Co.
Providence	Charles H. Child	Brown Bros. Co., Box 890.
Providence	Frank B. Comins	Aerphor Co., Box 1555.
Providence	Frederick I. Dana	Thomas Phillips Co.
Providence	A. Lockwood Danielson	Quinebaug Co., Box 900.
Providence	J. DeForest Danielson	Lockwood Co.
Providence	John W. Danielson	Lockwood Co.
Providence	R. H. Deming	Cotton Merchant, 10 So. Water St.
Providence	J. Herbert Foster	Cotton Merchant.
Providence	George A. Fuller	American Card Clothing Co.
Providence	William Gammell	Berkeley Co.
Providence	William B. Gowdey	Mill Supplies, Box 707.
Providence	William S. Granger	Granger Foundry & Machine Co.
Providence	Frederick Grinnell	Gen. Fire Extinguisher Co.
Providence	Z. D. Hall	B. B. & R. Knights Mills.
Providence	John H. Hambley	Quidnick Manufg. Co.
Providence	A. Walter Harris	A. W. Harris Oil Co., 326 S. Water St.
Providence	Elisha H. Howard	Harris Manufg. Co.

Providence	Joseph H. Kendrick	American Supply Co., Box 850.
Providence	Stephen A. Knight	Hebron Manufg. Co., Box 820.
Providence	Charles W. Lippitt	Silver Spring B. & D. Co.
Providence	Henry F. Lippitt	Social and Manville Cos.
Providence	Charles R. Makepeace	Mill Engineer, Box 973.
Providence	F. H. Maynard	Gen. Fire Extin. Co.
Providence	Thomas Mayor	Textile Machinery, 26 Olney St.
Providence	George C. Phillips	Thos. Phillips Co.
Providence	William C. Pierce	Elizabeth Mills, 564 Eddy St.
Providence	Stephen Minot Pitman	Narragansett Fire Ins. Co.
Providence	Thomas C. Powell	
Providence	R. H. Rice	Rice & Sargent, Steam Engine Co., 40 Codding St.
Providence	Frank P. Sheldon	Mill Engineer.
Providence	George W. Stafford	Knowles Loom Works.
Providence	Daniel J. Sully	Cotton Broker.
Providence	Edward P. Taft	Ponemah Mills.
Providence	Robert W. Taft	Coventry Co., Box 1144.
Providence	D. M. Thompson	Corliss Steam Engine Co.
Riverpoint	Arthur F. Brackett	Riverpoint & Arctic Mills.
Slatersville	Wm. P. Holt	Slatersville Mills, Box 315.
Slatersville	John M. Kimball	Slatersville Mills.
Valley Falls	Arnold B. Chase, Jr.	Woonsocket Mills.
Warren	Arnold Schaer	Warren Manufg. Co.
Warren	John Waterman	Warren Manufg. Co.
Westerly	Wm. W. Blades	Crefeld Mills.
Woonsocket	Malcolm Campbell	Woonsocket Mach. & Press Co.
Woonsocket	Chas. H. Gorton	Ballou Mill.
Woonsocket	Frank Harris	Hamlet Mills.
Woonsocket	Chas. H. Merriman, Jr.	Social Nourse Mills
Woonsocket	Ariel C. Thomas	Clinton Manufg. Co.
Woonsocket	Charles E. Thomas	Forestdale Manufg. Co.
Woonsocket	A. Tenny White	Globe Mill.

CONNECTICUT.

Baltic	Robert Rennie Taft	Baltic Power Co.
Bozrahville	Ira J. Martin	Bozrahville Manufg. Co.
Dayville	C. H. Truesdell	Attawaugan Co.
Jewett City	Harry W. Kimball	Jewett City Mills.
Jewett City	Moses Pierce	Aspencook Co.
Jewett City	James O. Sweet	Ashland Cotton Co.
Jewett City	A. A. Young, Jr.	Jewett City Mills.
Jewett City	Adelbert R. Young	Ashland Cotton Co.
Killingly	H. C. Atwood	Williamsville Manufg. Co.
Killingly	W. E. Atwood	Williamsville Manufg. Co.

Montville	W. S. Hume	Pequot Mills.
New Hartford	Robert R. Smith	Greenwoods Co.
New Haven	George S. Barnum	The Bigelow Co.
No. Grosvenordale	Frank M. Messenger	Grosvenor Dale Co.
Norwich	W. N. Blackstone	Attawaugan Co.
Norwich	W. R. Burnham	Uncasville Manufg. Co.
Norwich	C. H. Frisbie	Attawaugan Mills.
Norwich	W. G. Henderson	Shetucket Co.
Putnam	George W. Holt	Monohansett Manufg. Co.
Taftville	Joseph D. Aiken	Ponemah Mills.
Taftville	John Eccles	Ponemah Mills.
Wauregan	James A. Atwood	Wauregan Mills.
Wauregan	John Walter Atwood	Wauregan Mills.
Willimantic	E. S. Boss	Willimantic Linen Co.
Willimantic	Walter D. Brigham	Willimantic Linen Co.
Willimantic	John Scott	Willimantic Linen Co.

NEW YORK.

Cohoes	David S. Johnston	Cohoes Foundry & Machine Co.
Cohoes	J. E. Prest	Harmony Mills.
New York City	George Arms	Grand Hotel.
New York City	Edwin H. Baker	Bliss, Fabyan & Co., Box 2899.
New York City	Edward R. Ballou	Brighton Mills, 540 W. 23d St.
New York City	William L. Lyall	J. & W. Lyall Loom and Machine Works, 540 W. 23d St.
Oswego	G. H. Sayward	Standard Yarn Co.
Utica	D. W. Gray	Skenandoa Cotton Co.
Utica	Henry F. Mansfield	Utica Steam Cotton Mills and Mohawk Valley Cotton Mills.
Victory Mills	John Hannum	Saratoga Victory Manufg. Co.

NEW JERSEY.

Gloucester City	Philip H. Fowler	
Jersey City	Ernest Bridge	Jas. Chadwick & Bro. Ltd.
Jersey City	William Whitman, Jr.	Jas. Chadwick & Bro. Ltd.
Millville	Wm. B. Munroe	Millville Manufg. Co.
Newark	J. William Clark	Clark Thread Co.
Newark	H. E. Walmesley	Clark Thread Co.
Paterson	John W. Ferguson	Mill Engineer and Builder.
Vineland	John K. Russell	May's Landing Water Power Co.

PENNSYLVANIA.

Lancaster	S. S. Spencer	Conestoga Steam Mills.
Philadelphia	James Butterworth	H. W. Butterworth & Sons.

Philadelphia, Frankfort Sta.	Richard Garsed	Wingohocking Mills.
Philadelphia	George Wood	Millville Manufg. Co., Box 1277.
Trainer	William E. Trainer	Linwood Mills.

DELAWARE.

Wilmington	William P. Bancroft	V. P. Joseph Bancroft & Sons Co

MARYLAND.

Baltimore	James A. Gary	Gary Manufg. Co.

NORTH CAROLINA.

Charlotte	H. S. Chadwick	Dover Yarn Mills.
Charlotte	E. A. Smith	Charlotte Supply Co.
Charlotte	D. A. Tomkins	Chester & Patawba Mills.
Charlotte	J. P. Wilson	Dover Yarn Mills.
Henrietta	Fred S. Mosher	Henrietta Mills.
Kings Mt.	Philip S. Baker	Crowders Mt. Cotton Mills.
Kings Mt	F. Dilling	Dilling Cotton Mills.
Kings Mt.	C. E. Falls	Enterprise Manufg. Co.
Mt. Island	W. T. Jordan	Mt. Island Manufg. Co.
Reidsville	John W. Arrington	Edna Cotton Mills.

SOUTH CAROLINA.

Columbia	Charles K. Oliver	Columbia Mills Co.
Columbia	W. B. Smith Whaley	Mill Engineer.
Gaffney	H. D. Wheat	Gaffney Manufg. Co.
Lancaster	Leroy Springs	Lancaster Cotton Mills.
Langley	Arthur T. Smith	Langley Manufg. Co.
Newberry	Edward B. Wilbur	Newberry Cotton Mills.
Pelzer	B. F. Guy	Pelzer Manufg. Co.
Pelzer	Ellison A. Smyth	Pelzer Manufg. Co.
Walhalla	Horace L. Hayden	Walhalla Cotton Mills.

GEORGIA.

Atlanta	J. F. Dickinson	So. Belting Co.
Atlanta	Henry E. Fisher	Atlanta Cotton Mills.
Atlanta	James R. Pearce	Fulton Bag and Cotton Mills.
Atlanta	Osman D. Tilton	Exposition Cotton Mills., 22 Howard [St.
Augusta	Otis G. Lynch	Enterprise Manufg. Co.
Augusta	Joel Smith	J. P. King Mfg. Co.
Augusta	George R. Stearns	Riverside Mills.
Griffin	Albert G. Martin	Kincaid Manufg. Co., Box 272.
LaGrange,	Samuel Hale	Dixie Cotton Mills.

Lindale, Floyd Co.	Arthur W. Hunking	Mass. Mills in Georgia.
Savannah	Wm. A. Robinson	Savannah Cotton Mills.

KENTUCKY.

Stamford	John Hopkinson	Slagden & Kuckney Woolen Mills.

TENNESSEE.

Nashville	T. B. Dallas	Dallas Manufg. Co.

MISSOURI.

St. Louis	D. C. Ball	American Cotton Bale Imp. Co.
St. Louis	Jerome Hill	Jerome Hill Manufg. Co., 116 So. Main St.

LOUISIANA.

New Orleans	S. Odenheimer	Lane Mills.

ARKANSAS.

Little Rock	William Emmett Anderson	Standard Circular Cotton Co.

TEXAS.

Dickinson	Lawrence V. Elder	
Galveston	D. M. Ehrlich	Galveston C. & W. Mills.
Temple	W. T. Bessonette	Temple Gin Compress Co.
Waco	C. H. Botsford	American Cotton Bale Imp. Co.

CANADA.

Hamilton, Ont.	Charles Owen Dexter	Can. Colored Cotton Mills Ltd.
Hamilton, Ont.	Farquharson J. Muir	Can. Colored Cotton Mills Ltd.
Montreal, P. Q.	Alfred Hawkesworth	Merchants Manufg. Co.
Valleyfield, P. Q.	Louis Simpson	Montreal Cotton Co.

NEW BRUNSWICK.

St. John	John H. Parks	Wm. Parks & Sons, Ltd.

RECAPITULATION.

LOCATION OF MEMBERSHIP.

Maine	19
New Hampshire	25
Vermont	2
Massachusetts	224
Rhode Island	84
Connecticut	26
New York	10
New Jersey	8
Pennsylvania	5
Delaware	1
Maryland	1
North Carolina	10
South Carolina	9
Georgia	11
Kentucky	1
Tennessee	1
Missouri	2
Louisiana	1
Arkansas	1
Texas	4
Canada	4
New Brunswick	1
	450

IN MEMORIAM.

JOSEPH A. MOYES.

Mr. JOSEPH A. MOYES, late superintendent of the Androscoggin Mills, Lewiston, Maine, died at his post of duty on March 7, 1896. Mr. MOYES was born at Durham, P. Q., Canada, in 1850. He began working in the copper mines in his native town at the age of twelve years, but when he was sixteen he secured a position in the Pemberton Mills, Lawrence, Mass., where he remained for six years. He afterward went to Cornwall, P. Q., Canada, where he became overseer of the card room for the Canada Cotton Company, which position he held for eleven years, and from whence he left to enter into business for himself in partnership with two others. By this union the Cornwall Spinning Company was organized and successfully operated for six years when the mill was destroyed by fire in 1889.

After this loss he came to Lewiston where he secured the position of superintendent of the Androscoggin Mills. He was married in Cornwall on March 31, 1875. His widow and six children survive him.

He was a good citizen and beloved by all who knew him. He was a devout churchman and took a great interest in the welfare of the Trinity Episcopal Church in Lewiston, where he held the office of senior warden. His many friends in grateful remembrance of the noble life he lived while among them, have erected in Trinity Church a beautiful altar cross as a memorial to his memory.

In the executive position which he held at the head of the establishment, he was a valuable man to his employers and his loss will be a long felt one.

PROCEEDINGS.

In accordance with the legal notice, the stated Annual Meeting of this Association was held at Chipman Hall, Boston, Mass., on April 29 and 30, 1896.

The following members were present:

HONORARY MEMBER.

AMBROSE EASTMAN, Boston, Mass.

ACTIVE MEMBERS.

ALFRED E. ADAMS, Whitinsville, Mass.
STEPHEN L. ADAMS, Central Falls, R. I.
JOHN S. ADAMS, JR., Adams, Mass.
JOSEPH D. AIKEN, Taftville, Conn.
ABEL T. ATHERTON, Central Falls, R. I.
EDWARD ATKINSON, Boston, Mass.
EDWARD W. ATKINSON, Boston, Mass.
H. C. ATWOOD, Killingly, Conn.
JAMES A. ATWOOD, Wauregan, Conn.
CHARLES L. BAILEY, Waltham, Mass.
EDWIN N. BARTLETT, North Oxford, Mass.
JOSEPH P. BATTLES, Newton, Mass.
WILLIAM W. BLADES, Westerly, R. I.
NATHANIEL B. BORDEN, Fall River, Mass.
THOMAS J. BORDEN, Fall River, Mass.
STEPHEN N. BOURNE, Manchester, N. H.
ARTHUR F. BRACKETT, Riverpoint, R. I.

JOHN W. BROWN, West Warren, Mass.
O. S. BROWN, Salmon Falls, N. H.
ROBERT BURGESS, New Bedford, Mass.
EDWARD N. BURKE, Lowell, Mass.
ARNOLD B. CHACE, JR., Valley Falls, R. I.
H. S. CHADWICK, Charlotte, N. C.
ERNEST E. CLARK, Wilkinsonville, Mass.
JEREMIAH CLARK, Lowell, Mass.
FRANK B. COMINS, Providence, R. I.
JOHN J. CONNELL, Taunton, Mass.
WOODBURY K. DANA, Westbrook, Me.
A. LOCKWOOD DANIELSON, Providence, R. I.
CHARLES W. DENNETT, North Adams, Mass.
P. Y. DENORMANDIE, New Bedford, Mass.
CHARLES C. DIMAN, New Bedford, Mass.
ALBERT W. DIMICK, Lawrence, Mass.
EBEN S. DRAPER, Hopedale, Mass.
GEORGE A. DRAPER, Hopedale, Mass.
GEORGE OTIS DRAPER, Hopedale, Mass.
WILLIAM F. DRAPER, Hopedale, Mass.
JOHN ECCLES, Taftville, Conn.
FREDERICK W. ELY, Geenville, N. H.
WILLIAM EVANS, Fall River, Mass.
WILLIAM FIRTH, Boston, Mass.
CHARLES H. FISH, Dover, N. H.
HERBERT FISHER, Taunton, Mass.
WILLIAM B. FITTZ, Oakdale, Mass.
FREDERICK A. FLATHER, Lowell, Mass.
M. F. FOSTER, Milford, N. H.
C. H. FRISBIE, Norwich, Conn.
CHARLES E. GETCHELL, Waltham, Mass.
DANIEL GILLIGAN, Fall River, Mass.
ALFRED M. GOODALE, Waltham, Mass.
GEORGE P. GRANT, Boston, Mass.
GEORGE P. GRANT, JR., Fitchburg, Mass.
R. A. GRAY, Allenton, R. I.
STEPHEN GREENE, Boston, Mass.
JOHN GREGSON, Fall River, Mass.
ARTHUR H. GULLIVER, Ashton, R. I.

FRANK J. HALE, Newton Upper Falls, Mass.
Z. D. HALL, Providence, R. I.
JOHN F. HAMLET, Fall River, Mass.
J. O. HANNUM, Victory Mills, N. Y.
WILLIAM B. HAWES, Fall River, Mass.
ALFRED HAWKESWORTH, Montreal, P. Q.
W. G. HENDERSON, Norwich, Conn.
WILLIAM R. HILL, S. Hadley Falls, Mass.
GEORGE H. HILLS, Fall River, Mass.
JOHN H. HINES, Burlington, Vt.
CHARLES H. HOBBS, Thorndike, Mass.
JOHN HOLLAND, Dover, N. H.
GEORGE W. HOLT, Putnam, Conn.
GEORGE L. HOOPER, Lowell, Mass.
ROLAND R. KELLY, Williamstown Station, Mass.
JOSEPH H. KENDRICK, Providence, R. I.
HERVEY KENT, Exeter, N. H.
WILLIAM J. KENT, New Bedford, Mass.
NATHANIEL B. KERR, New Bedford, Mass.
JOHN KILBURN, Belmont, Mass.
HARRY W. KIMBALL, Jewett City, Conn.
JOHN M. KIMBALL, Slatersville, R. I.
ALBERT F. KNIGHT, Adams, Mass.
JESSE A. KNIGHT, Phœnix, R. I.
STEPHEN A. KNIGHT, Providence, R. I.
FRED LACEY, North Adams, Mass.
WALTER H. LANGSHAW, New Bedford, Mass.
ABBOTT F. LAWRENCE, Taunton, Mass.
EVAN ARTHUR LEIGH, Boston, Mass.
J. COLBY LEWIS, Centreville, R. I.
ARTHUR H. LOWE, Fitchburg, Mass.
DAVID LOWE, Fitchburg, Mass.
WILLIAM L. LYALL, New York City.
HERBERT LYMAN, Boston, Mass.
JAMES R. MACCOLL, Pawtucket, R. I.
CHARLES L. MACOMBER, Taunton, Mass.
CHARLES R. MAKEPEACE, Providence, R. I.
IRA J. MARTIN, Bozrahville, Conn.
RUFUS A. MAXFIELD, Lowell, Mass.

THOMAS MAYOR, Providence, R. I.
ROBERT MCARTHUR, Biddeford, Me.
CHARLES D. MCDUFFIE, Manchester, N. H.
WILLIAM J. MCLOON, Waltham, Mass.
WILLIAM P. MCMULLAN, Salem, Mass.
JOHN TEMPEST MEATS, Taunton, Mass.
CHARLES H. MERRIMAN, JR., Woonsocket, R. I.
FRANK M. MESSENGER, No. Grosvenor Dale, Conn.
ROSCOE S. MILLIKEN, Lawrence, Mass.
EDWARD A. MONGEON, Blackstone, Mass.
FRED W. MOORE, Millbury, Mass.
OLIVER H. MOULTON, Lowell, Mass.
FARQUHARSON J. MUIR, Hamilton, Ont., Canada.
WM. B. MUNROE, Millville, N. J.
ROSCIUS C. NEWELL, Three Rivers, Mass.
WM. G. NICHOLS, So. Hadley Falls, Mass.
ELMER E. PAGE, Saco, Me.
O. B. PARKER, Central Falls, R. I.
WALTER E. PARKER, Lawrence, Mass.
WM. C. PEIRCE, Providence, R. I.
HAVEN C. PERHAM, Lowell, Mass.
HENRY C. PHILLIPS, Webster, Mass.
ANDREW G. PIERCE, Jr., New Bedford, Mass.
REUBEN PILLING, JR., Greenville, R. I.
HERBERT L. PRATT, Lewiston, Me.
J. E. PREST, Cohoes, N. Y.
ROBERT REDFORD, Lawrence, Mass.
ROSCOE C. REYNOLDS, Lewiston, Me.
F. H. RICE, West Boylston, Mass.
CHARLES H. RICHARDSON, Lowell, Mass.
CHARLES D. ROBINSON, Crompton, R. I.
J. H. SAWYER, Boston, Mass.
ARNOLD SCHAER, Warren, R. I.
THOMAS C. SHELDON, Fitchburg, Mass.
WILLIS S. SHEPARD, Boston, Mass.
WILLIAM F. SHERMAN, Lawrence, Mass.
HERBERT H. SHUMWAY, Taunton, Mass.
ROBERT R. SMITH, New Hartford, Conn.
GEORGE E. SPOFFORD, Natick, R. I.

S. S. Spencer, Lancaster, Pa.
Walter F. Stiles, Fitchburg, Mass.
W. H. Summersby, Pontiac, R. I.
James O. Sweet, Jewett City, Conn.
Robert Rennie Taft, Baltic, Conn.
James W. Taylor, Taunton, Mass.
Richard Thackeray, Fall River, Mass.
Edward W. Thomas, Lowell, Mass.
Ralph E. Thomson, Fitchburg, Mass.
D. M. Thompson, Providence, R. I.
James P. Tolman, Boston, Mass.
C. H. Truesdell, Dayville, Conn.
Oscar B. Truesdell, Fiskdale, Mass.
George E. Tucker, Ware, Mass.
William D. Twiss, Lawrence, Mass.
James Waring, Fall River, Mass.
Joseph W. Wattles, Canton Junction, Mass.
T. B. Wattles, Penacook, N. H.
George W. Weeks, Clinton, Mass.
Channing Whitaker, Lowell, Mass.
A. Tenny White, Woonsocket, R. I.
Henry T. Whiten, Northbridge, Mass.
Alfred N. Whiting, Oakdale, Mass.
William Whittam, Jr., Jersey City, N. J.
George F. Whittin, Manchester, N. H.
Henry M. Wilcox, Millbury, Mass.
Theop. W. Wilmarth, Millbury, Mass.
Thomas Wilmarth, Saundersville, Mass.
A. S. Winslow, Newburport, Mass.
C. J. H. Woodbury, Lynn, Mass.
Adelbert R. Young, Jewett City, Conn.

ASSOCIATE MEMBERS.

Geo. R. Babbitt, Providence, R. I.
Colin C. Bell, North Cambridge, Mass.
William H. Bent, Taunton, Mass.
J. Payson Bradley, Boston, Mass.
H. Martin Brown, Providence, R. I.

John H. Burghardt, Boston, Mass.
Eugene E. Burnham, Lawrence, Mass.
James Butterworth, Philadelphia, Pa.
Malcolm Campbell, Woonsocket, R. I.
Fred A. Chace, Providence, R. I.
Charles H. Child, Providence, R. I.
Peter H. Corr, Taunton, Mass.
Frederick I. Dana, Providence, R. I.
G. E. Emmons, Lawrence, Mass.
T. C. Entwistle, Lowell, Mass.
George A. Fuller, Providence, R. I.
H. P. Garland, Biddeford, Me.
Royal W. Gates, Lowell, Mass.
John H. Haworth, Lowell, Mass.
William L. Haines, Boston, Mass.
Jerome Hill, St. Louis, Mo.
C. H. Hutchins, Worcester, Mass.
David Jackson, Pawtucket, R. I.
Geo. H. Meader, Boston, Mass.
George B. Morrison, Boston, Mass.
Sidney B. Paine, Boston, Mass.
Stephen Minot Pitman, Providence, R. I.
Richard H. Rice, Providence, R. I.
John M. Russell, Worcester, Mass.
George W. Stafford, Providence, R. I.
G. A. Thudium, Malden, Mass.
William V. Threlfall, Newton Upper Falls, Mass.
Frank H. Underwood, Boston, Mass.
Justin A. Ware, Worcester, Mass.
Walter S. Watson, Lowell, Mass.
Erving Y. Woolley, Boston, Mass.

MORNING SESSION,

APRIL 29, 1896.

Chipman Hall, Boston, Mass. The meeting was called to order at 11 A. M. by the President, Mr. ALFRED M. GOODALE, in the chair, and the Secretary read the following call for the meeting:

CALL FOR MEETING.

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

Boston Meeting, No. 60.

BOSTON, MASS., April 8, 1896.

Dear Sir:

The stated annual meeting of the Association will be held at Boston, Mass., Wednesday and Thursday, April 29 and 30, 1896. The sessions will be held in Chipman Hall, in the new Tremont Temple on Tremont Street, a short distance south of School Street. Chipman Hall is on the sixth floor and is reached by the elevators.

FIRST SESSION.

WEDNESDAY, APRIL 29, FROM 11 A. M. TO 12 NOON.

Business meeting for the election of members, annual reports, and election of officers for the ensuing year.

SECOND SESSION.

WEDNESDAY, APRIL 29, AT 2 P. M.

A. Dobby and Jacquard Weaving.

Mr. GEORGE W. STAFFORD, Providence, R. I.

TOPICAL QUESTIONS.

4. What is the best motion for weaving Jacquard patterns, single or double action machines?

5. Do weavers run as many looms on Jacquard as on dobbies?

6. Is it profitable to use dobbies for over twenty harnesses, or is it better to use Jacquards?

7. Ought a manufacturer to receive more per pound for goods made on Jacquard looms than on dobby looms, both using same numbers; sley and picks being the same?

9. Is it advisable for manufacturers to run looms on fine numbers at the same speed as on coarse numbers?

B. Weave Shed Construction.

Mr. JAMES R. MACCOLL, Pawtucket, R. I.

TOPICAL QUESTIONS.

10. Why is the over-pick so universally used in English looms, and the under-pick on American looms?

15. In the construction of a weave shed is it best to provide a basement for shafting and other uses, or is it best to dispense with a basement and drive the looms from shafting over head?

C. The Northrop Loom.

Mr. FRANK M. MESSENGER, North Grosvenor Dale, Conn.

Messrs. H. D. WHEAT of Gaffney, S. C., and J. H. HINES of Burlington, Vt., will give their experiences with the Northrop loom.

TOPICAL QUESTIONS.

3. Will the new Draper loom require more repairs than an ordi-

nary loom, both being run at the same speed? If so, how much will these repairs add to the cost of cloth made on the Draper loom?

18. Can the Northrop loom be run profitably at the same speed on print cloths as the Whitin loom?

D. Cotton Manufacturing in Switzerland.

HERR TH. OTTO SCHWEITZER, Frauenfeld, Switzerland.

TOPICAL QUESTION.

8. How many looms do Swiss cotton weavers run on fancy weaving, either Jacquard or dobby? Also, what numbers of warp and filling in same with speed of looms?

E. Tests showing power required to drive various widths and makes of looms.

Contributed by various members.

THURSDAY, APRIL 30, 10 A. M. TO 1 P. M.

F. Textile Education in the Manufacture of Textiles.

Mr. EDWARD W. FRANCE, Philadelphia, Pa.

G. Public Textile Education in Massachusetts.

Mr. FRANK P. BENNETT, Boston, Mass.

TOPICAL QUESTION.

2. What benefit will the people of the State of Massachusetts derive by the establishment of textile schools?

H. The Future of Cotton Manufacturing in the South.

Mr. D. A. TOMPKINS, Charlotte, N. C.

By the courtesy of Gen. FRANCIS A. WALKER, LL. D., President of the Massachusetts Institute of Technology, some examples of the work of the students in the Lowell School of Practical Design will be on exhibition in the hall.

TOPICAL QUESTIONS.

1. How many ends per thousand spindles should be allowed to be

broken down in a spinning room where the roving is furnished well prepared and the yarns vary in numbers from 20 to 80?

11. What means can be used to prevent the formation of anchor ice?

12. What can be offered on the subject of the influence of moisture in the air affecting the strength of yarn?

13. What is the quantity of steam properly required for slashers and the best means of applying the same?

14. What steam pressure should be carried on slashers running on colored work, and what is the best means of returning to boilers the condensation from slashers?

17. Can cotton manufacturers do anything more than they are doing at present to prevent the recurrence of boiler explosions? Will the new Massachusetts law which went into effect August 1, 1895, requiring the examination of engineers and firemen, help materially in this direction?

THURSDAY, APRIL 30. AFTERNOON.

As guests of the City of Boston, by Hon. JOSIAH QUINCY, Mayor, the members of the Association are invited to an EXBURSION IN BOSTON HARBOR on the steamer J. Putnam Bradlee, visiting points where they will have an opportunity to examine the methods of disposal of the sewage of the city. Full particulars of hour and place of leaving will be announced at the meeting. Admission to the boat only by tickets which will be distributed at the meeting.

Members desiring to visit the CENTRAL POWER STATION OF THE WEST END STREET RAILWAY COMPANY can obtain passes on application and showing membership badges at the office of the Station, No. 439 Albany Street, on either of the days of the meeting, between 8 A. M., and 6 P. M. Take any blue or green car going south on Washington street, *except blue Dorchester Avenue cars*, and leave the car at Waltham Street.

Members wishing to visit the Exhibition of Paintings at the

Boston Art Club, corner of Dartmouth and Newbury Streets, on Wednesday or Thursday evening, can obtain complimentary tickets from the Secretary at the meetings.

Members are especially requested to examine the list of *Topical Questions* and to come prepared to give to their fellow members the benefits of their experience. Those who will not be able to attend the meeting can send their discussions in writing to the Secretary to be read in their absence.

Blank proposals for membership can be obtained at the rooms of the Association or from the Secretary, P. O. Box 3672, Boston, Mass., and it is important that nominations for membership be in his hands as early as convenient.

In answer to numerous inquiries on the subject of back numbers of the Transactions, it may be stated that the files of the Association were destroyed by fire in 1890, and there is a limited supply of copies, beginning with the report of the meeting of April, 1890, the price of which as fixed by the Board of Government, is fifty cents to members, and five dollars to non-members. Printed lists of members sent free on application.

The headquarters of the Association, Room 501 John Hancock Building, 178 Devonshire Street, and 35 Federal Street, are open from 8 A. M. to 6 P. M., and a stenographer is in attendance who will attend to any correspondence or typewriting for the members. The leading textile and mechanical papers are on file, and a beginning has been made on a library of textiles, for which further contributions are respectfully solicited.

By order of the Board of Government,

C. J. H. WOODBURY,

Secretary.

The SECRETARY. Mr. President, I certify that I have mailed copies of the call to the meeting to every member at least ten days in advance of the present date in accordance with Article 14 of the Constitution of this organization.

A quorum is now present.

The PRESIDENT. The Secretary will read the records of the last meeting.

Records of the meeting held at Atlanta, Ga., October 24 and 25, 1895, read by the Secretary.

On motion duly seconded it was voted that the records be approved.

The PRESIDENT. The Secretary will read the report of the Secretary and Treasurer for the last year.

TREASURER'S REPORT.

C. J. H. WOODBURY, TREASURER, IN ACCOUNT WITH THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

April 1, 1895 to April 1, 1896.

Dr.

Cash on hand April 1, 1895,	$578 73	
Active membership dues,	1,750 00	
Associate membership dues,	540 00	
Active admission fees,	680 00	
Associate admission fees,	1,400 00	
Rent of desk room,	94 68	
Interest,	37 60	
Sale of Transactions and miscellaneous,	76 91	
Total,		$5,157 92

Cr.

Rent of office,	$600 86	
Secretary and Treasurer,	500 00	
Reports of meetings,	146 40	
Notices, envelopes and stationery,	188 58	
Meeting expenses,	131 77	
Expenses of Board of Government	279 60	
Printing and distributing Transactions,	1,004 71	
Amount forward,		$2,851 92

Amount forward,	$2,851 92	
Engraving,	147 41	
Badges,	77 35	
Stenographer and proof-reading,	316 67	
Special copies of paper,	22 25	
Post-office box,	10 00	
Counsel, oath and copyright,	28 00	
Postage, telegrams and express,	123 75	
Advance papers Atlanta Meeting,	46 55	
Office furniture,	12 41	
Note of Everett Mills,	1,000 00	
Cash on hand April 1, 1896,	521 61	
Total,		$5,157 92

AUDITOR'S REPORT.

I hereby certify that the accounts from April 1, 1895, to April 1, 1896, are correctly cast, that all payments are properly vouched by bills approved by the Auditing Committee of the Board of Government, that the funds are kept on deposit in the name of the New England Cotton Manufacturers' Association; and that the amount of deposit April 1, 1896, agrees with the balance on the books, viz.: $521.61. The loan of two thousand dollars ($2,000) to the Everett Mills, Dec. 3d, was authorized by vote of Directors, Nov. 27, 1895. One thousand dollars ($1,000) was paid back Feb. 5, 1896.

J. H. SAWYER,
Auditor.

Boston, April 28, 1896.

In addition to the figures submitted giving the actual receipts and expenditures during the past year, it may be well to state that the total income earned during the year, including amounts due from members will be $5,003.55.

Cash receipts,	$4,579 19	
Due from members April 1, 1896,	390 00	
Due for extra copies of Transactions,	29 00	
Accrued interest,	5 36	
		$5,003 55
Expenditures,		3,636 31
Net income,		$1,367 24

These figures exceed those of any previous year, as the following table will show, and it is introduced for the purpose of placing on the records of the Association the facts pertaining to its financial statements for the last six years, which have not hitherto been printed in the Transactions:

	Membership.		Transactions.			Finances.		
Fiscal Year Ending April 1.	Enrollment.	Members Elected.	Volume Number.	Pages in Volume.	Pages for Year.	Receipts.	Expenses.	Cost Per Page of Transactions.
1891	246	14	48 49	43 62	105	$1,142 00	$926 08	$8 82
1892	254	11	50 51	129 60	189	1,260 68	1,374 46	7 27
1893	244	31	52 53	63 94	157	1,678 33	1,608 25	12 12
1894	257	16	54 55	84 86	170	1,414 58	1,807 60	10 63
1895	270 *292	35	56 57	73 230	303	1,947 07	1,957 64	6 46
1896	383 *423	131	58 59	310 327	637	4,579 19	3,636 31	5 71

*Membership at Autumn Meeting.

The expenses of an organization of this character can be made almost anything which can be desired. A common discretion, however, requires that they shall not be pitched upon so high a key as to overstep the bounds of business prudence. It is, however, believed that the work of this organization can be broadened to include an even greater measure of usefulness on all matters which strictly pertain to the manufacturer's side of the problems of transforming cotton into cloth, and the privileges of its membership should be so valuable that persons qualified for membership could not afford to forego the prerogatives which it confers.

The recent accessions to the membership have given greater resources, which have been utilized in extending the work of the organization and also increasing the size of the Transactions. It was considered best that this course should be followed as long as there were resources at hand for the purpose, but this has been possible only through the large additions to the funds derived from contributions from the admissions of new members, particularly those of the class of Associate Members, which is affiliated with the work of the organization in the most valuable manner. However, it is not prudent to estimate upon expenditures of income derivable from the rapid growth of this organization, because the qualifications for membership impose a limit upon the number, and before many years the income will approach more nearly to that obtainable from the dues.

In comparison with other technical societies issuing Transactions, the dues of the members of the Cotton Manufacturers' Association are less than half. This is the result of the most scrupulous care and economy in the administration.

As a means of providing for future needs, the Board of Government voted, at the time of the fall meeting, to place the receipts from Associate members for that meeting in a special fund for the good of the Association. The amount at the end of the fiscal year available for that fund amounted to $455, but as there had already been $1,000 invested in a corporation note by vote

of the Board of Government, it was considered that this more than covered the requirements of the vote on the fund.

The rental of the headquarters has been reduced during the year. The question of providing other quarters at a less rental was carefully considered, but in view of the fact of the diminution of the rental and that we are able to let a desk room to a stenographer upon mutually advantageous terms, it was not found that a change could be made to another fire-proof building to the advantage of the Association. The present net cost of the rental of the room is $450 per year, which includes a safe in a large fire-proof vault.

It is of the highest importance that the records and Transactions of the Association be kept in a fire-proof building where the history of Feb. 4, 1890, will not repeat itself in the destruction of the records, and extra copies of the Transactions.

The Board of Government has declined numerous applications for desk room in the office, also propositions to allow advertising appendix to the volumes of the Transactions, preferring to maintain the independent position of the past in these respects, rather than to adopt the methods of other technical organizations in this respect.

The Board of Government has declined to join in any petitions or memorials to Congress, or to affiliate with other organizations on matters of a public nature, considering that such action was outside of the scope of this organization, although many of the requests were upon subjects which would doubtless commend themselves to the majority of the membership.

This meeting will close with a membership of about 450, and the additional responsibilities from everything which the large membership involves requires that the affairs of the Association should be presented in close detail to the members.

The members of the Board of Government have held twelve regular and three adjourned meetings during the year in the exercise of the duties to which they were elected; and in addition the work of their sub-committees has been laborious, par-

ticularly those of the Atlanta Meeting, in which the arrangements for the meeting and the transportation of the members imposed arduous work and heavy cares.

The results of this work have been recorded throughout the Transactions, and no attempt to particularize has been made.

During the year a seal has been designed for the Association bearing in its centre a loom of the pattern of 1865, the date of founding the organization, which is stated as well as the date of incorporation. The centre is encircled by a wreath of cotton in full bloom, the right hand being Sea Island, and the left hand upland cotton. The name of the NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION is surrounded by hanks of yarn knotted together forming a polygonal border. The picture of the loom was furnished by the courtesy of Mr. ROBERT H. STEVENSON, Treasurer of the Lowell Machine Shop, the Sea Island cotton by Mr. ELIAS L. RIVERS of James Island, S. C., and the upland cotton by Mr. WASHINGTON JONES of Columbia, S. C.

There has been but one death during the year, that of Mr. JOSEPH A. MOYES, who fell in the mill, dying in the harness like his fellow member of a year ago. The Transactions will contain a notice of his career written by one who was a friend as well as a business associate.

In advance of mailing the Transactions a notice with a postal card receipt was sent to the members, and although the addresses were checked twice, several of the members reported that they failed to receive their copies and duplicates have been sent. The importance of the postal card receipts may be appreciated when it is stated that eighty-three names of the membership as contained in the Transactions of last October will be changed, but one of these changes is due to an error, and the request for information respecting change of address which is contained at the head of the list of members is here repeated, for the sake of those personally interested.

The headquarters are kept open for the members with sten-

ographer in attendance from 8 A. M. to 6 P. M. While the clerical work and the possessions of the organization require a room, yet the purpose for which this was opened was to serve as a headquarters for the members when in Boston. A list is kept of visiting members, and over half the membership have called at the rooms during the year.

The following periodicals are sent regularly by the publishers and are kept on file on our shelves: *The Iron Age, The Manufacturers' Record, Fibre and Fabric, Electrical Review, Textile Recorder, Wool and Cotton Recorder, Home Market Bulletin, The Textile World, Boston Journal of Commerce, Industrial Record, Lord's Power and Machinery Magazine, Cassier's Magazine.* There have been contributions of forty-six volumes during the year, and this beginning of a library has been frequently consulted by members of the Association. It is, however, desired that there should be further contributions of books, especially those pertaining to the textile manufacturing.

Whatever the logic of figures in the report may prove in regard to the welfare of this Association, the semi-annual Transactions furnish the standards by which to measure the extent to which it fulfills its mission. These volumes are unique in their contributions of individual experience and well-grounded opinions upon the art of cotton manufacturing, and are kept closely in accord with the tradition of the Association, which limits its field to the productive features of the subject.

These results have been possible only through the hearty co-operation of the membership in everything pertaining to the interests of the organization.

Respectfully submitted,

C. J. H. WOODBURY,

Secretary and Treasurer.

The PRESIDENT. Gentlemen, you have heard the report of the Secretary and Treasurer. What action will you take?

On motion duly seconded it was voted that the report be accepted and placed on file.

The PRESIDENT. By the expiration of the terms of office, there will be vacancies in the following: President, two Vice-Presidents, and two members of the Board of Directors.

Mr. CHARLES D. MCDUFFIE. I move that a committe of three be appointed by the chair to nominate a list of officers to fill vacancies for the ensuing year.

Motion carried.

The PRESIDENT. The chair appoints Messrs. CHARLES D. MCDUFFIE, S. S. SPENCER and CHARLES H. FISH as that committee, who will retire and submit their report later.

The next action is the election of members whose nominations have been approved by the Board of Government.

The Secretary will read the ballot of candidates for membership.

The Secretary read the following:

FOR ACTIVE MEMBERSHIP.

JOHN S. ADAMS, Jr., Supt. Adams Bros. Mfg. Co., Adams, Mass.
By Mr. ALBERT F. KNIGHT.

WILLIAM N. BLACKSTONE, Treas. Attawaugan Co., Norwich, Conn.
By Mr. C. H. FRISBIE.

ERNEST E. CLARK, Supt. Sutton Mfg. Co., Wilkinsonville, Mass.
By Mr. HENRY C. PHILLIPS.

P. Y. DENORMANDIE, Supt. Potomska Mills, New Bedford, Mass.
By Mr. ERVING Y. WOOLLEY.

JOHN DROWNE, Supt. Cocheco Mfg. Co., Dover, N. H.
By Mr. CHARLES H. FISH.

WILLIAM EVANS, Supt. Richard Borden Mfg. Co., Fall River, Mass.
By Mr. GEORGE W. STAFFORD.

DANIEL GILLIGAN, Supt. Pocasset & Metacomet Mills, Fall River, Mass.
By Mr. JOHN F. HAMLET.

JOSEPH WARREN GREENE, Supt. Hamilton Web Co., Hamilton, R. I.
By Mr. ROBERT A. GRAY.

W. G. HENDERSON, Agent Shetucket Co., Norwich, Conn.
By Mr. C. H. FRISBIE.

WALTER H. LANGSHAW, Supt. Dartmouth Mfg. Corp., New Bedford, Mass.
By Mr. WILLIAM J. KENT.

ROSCOE S. MILLIKEN, Supt. Pemberton Co., Lawrence, Mass.
By Mr. FREDERICK E. CLARKE.

SAM'L L. PARKER, Supt. Turners Falls Mills, Turners Falls, Mass.
By Mr. JAMES C. DEANE.

REUBEN PILLING, Jr., Supt. Granite Mills Co., Greenville, R. I.
By Mr. ROBERT A. GRAY.

C. W. RIDER, Treas. Merrick Thread Co., Holyoke, Mass.
By Mr. JOSEPH M. DUNHAM.

WILLIAM A. ROBINSON, Treas. Savannah Cotton Mills, Savannah, Ga.
By Mr. HENRY F. LIPPITT.

GEORGE H. SHAPLEY, Mgr. Silver Lake Co., 78 Chauncy St., Boston, Mass.
By Mr. JAMES P. TOLMAN.

WILLIS S. SHEPARD, Pres. American Net and Twine Co., 34 Commercial St., Boston, Mass.
By Mr. GEORGE P. GRANT.

GEORGE E. SPOFFORD, Asst. Supt. Natick Mill, Natick, R. I.
By Mr. ARTHUR P. MANN.

C. H. TRUESDELL, Supt. Attawaugan Co., Dayville, Conn.
By Mr. C. H. FRISBIE.

WILLIAM D. TWISS, Supt. Everett Mills, Lawrence, Mass.
By Mr. FRED. C. MCDUFFIE.

ARTHUR W. WARREN, Treas. W. Warren Thread Works, Westfield, Mass.
By Mr. ALFRED M. GOODALE.

EBEN C. WILLEY, Supt. Mauchaug Company, Mauchaug, Mass.
By Mr. ALBERT F. KNIGHT.

FOR ASSOCIATE MEMBERSHIP.

COLIN C. BELL, Pres. and Treas. Laminar Fibre Co., North Cambridge, Mass.
By Mr. EDWARD W. THOMAS.

WILLIAM H. BENT, Treas. Mason Machine Works, Taunton, Mass.
By Mr. WILLIAM J. KENT.

W. T. BESSONETTE, Sec. Temple Gin and Compress Co., and Inventor of Cylindrical Ball and Roller Compress, Temple, Texas.
By Mr. STEPHEN A. KNIGHT.

J. F. DICKINSON, Treas. So. Belting Co., Atlanta, Ga.
By Mr. ALBERT G. MARTIN.

WILLIAM L. HAINES, Agt. for Brooks & Doxey, of Manchester, Eng., 161 Pearl St., Boston, Mass.
By Mr. CHARLES R. MAKEPEACE.

JEROME HILL, Pres. Jerome Hill Cotton Co., 119 South Main St., St. Louis, Mo.
By Mr. ARTHUR H. LOWE.

WINTHROP THAYER, Mgr. Babcock & Wilcox Co., 8 Oliver St., Boston, Mass.
By Mr. WILLIAM J. KENT.

FRANK H. UNDERWOOD, Manager Dodge Mfg. Co., 137 Purchase St., Boston, Mass.
By Mr. CHARLES H. MANNING.

The SECRETARY. In addition to the foregoing there are a number of propositions for membership which were not sent in early enough to be acted upon by the Board of Government, and therefore lie over until the autumn meeting.

The PRESIDENT. The chair will appoint Mr. HERBERT FISHER and Mr. GEORGE P. GRANT, Jr., as tellers to distribute, collect and count ballots for membership and report the same at the afternoon session.

Have all voted who wish? If so, I declare the ballot closed.

You will now listen to the report of the nominating committee.

Mr. CHARLES D. MCDUFFIE, Chairman. The committee have attended to their duty and report: for President ARTHUR H. LOWE; for Vice-Presidents, WILLIAM J. KENT, FRED. C. MCDUFFIE; Directors, RUSSELL W. EATON, one year, to fill vacancy caused by the nomination of Mr. LOWE; ALBERT F. KNIGHT, three years; JOHN ECCLES, three years.

The report of the committee was accepted.

The PRESIDENT. I will state, gentlemen, it is the custom now, as the President serves one year, for the retiring President to conduct the April meeting. The ballot therefore, will be taken to-morrow afternoon and the new President will be installed the last thing to-morrow afternoon. If you will give attention to some notices from the Secretary.

The Secretary gave some notices pertaining to the details of the meeting.

PRESIDENT'S ANNUAL ADDRESS.

When Mr. THOMAS was president of the Association, at the first meeting after he had taken full charge, he delivered an address instituting a custom which I think it well to follow.

It did not seem to me best that I should make a formal address at our Atlanta meeting, neither do I feel called upon now to give more than a short sketch of the history of the past year, and the work done in the same, and to speak briefly upon two or three points which I shall ask the Association to consider. The membership on the first of May, 1895, was 270; the membership to-day is 451, showing an increase of 181 active and associate members.

The Board of Government during the past year has voted

that all the monies received, both from initiation fees and dues from associate members, be invested, forming a permanent fund, only to be drawn upon in case of emergencies or in researches requiring more than our usual income. While our expenses the past year have been larger than usual, I am happy to say that we have a balance on hand of $1,521.61, $1,000 of which is invested on demand note.

One large item of expense the past year has been the room of the Association in the John Hancock building on Devonshire Street. This room is the headquarters of the Association, and was started as an experiment, and the Board finds that since May to the present time there have been about 200 visitors to the room. Those members living farthest from Boston use the room as their headquarters during their stay in Boston. We have the nucleus of a library and files of all the textile papers which must be taken care of. We *must* have headquarters. They can be simple or elaborate. It is merely a question how we use our income when the annual dues are at the low rate of $5 per member per annum. For this sum each member the past year has received 637 pages of Transactions, and I think in the Transactions alone they have had value received.

The Atlanta meeting was a success as was evidenced by the unanimous statement of the ninety odd members who were present at the meeting. It was a success not only in the value of the papers presented and in the interest shown in those papers; not only in the added membership as a result of the meeting; not only in the interest shown by the Southern people and the Southern members in the Association; not only in the personal knowledge gained by those members in each other who went on the excursion; but chiefly, I hold, it was a success in the fact that the Association by that excursion made a new departure, one that advertised it in the best possible way, and one that showed that good results could come outside the beaten paths that the Association heretofore has always trod. I was not one of those who voted for the trip to Atlanta, so that my evidence is unprejudiced.

I had the pleasure not long since of listening to a paper on the cotton mill of the future, written by one of the most experienced manufacturers in Massachusetts, a past president of this Association, and a description was given of the future mill, based largely on the improvements of recent years. For instance, there is a loom at the present time running 1,000 picks per minute. There is a ring spinning room in Massachusetts in which one girl tends 3,000 spindles, and which is left running during the noon hour without attendance, and no clearer waste is made. The actual production of one weave room (full description of which will be given at this meeting) is 97 per cent. of possible; month in and month out. Other improvements mentioned in the paper referred to, as expected in the near future, were cotton properly ginned and baled; laps made in the South and sent here to go on our cards, doing away with our Northern picker rooms and our picker waste. I have quoted briefly some of the points mentioned in this paper to show certain changes at hand and to come in the near future, and to ask if you do not think with me that some changes might be made in our Association to correspond with the altered conditions under which we are now working. To look ahead and predict the future of this Association exactly as in the paper I have quoted from, the future cotton mill is predicted, will be no easy task, and it may or may not meet with your approval, yet I am minded to try it in spite of the very valuable advice of "Don't ever prophesy unless you know."

The competition of the present time is severe; it will become more and more as time goes on, with cotton mills as with all other business, a question of evolution, a struggle for existence and the survival of the fittest. These future cotton mills, like the present ones, will be run largely by members of this Association. At present our membership is composed 80 per cent. of mill agents and 20 per cent. of mill treasurers, and while it is not perhaps fair to state that 11,000,000 spindles are represented by this Association, you and I know that upon the

agents of this Association depends very largely the successful running of those 11,000,000 spindles. Bearing strictly in mind that the great majority of our members are agents, and that the dues are paid by the members, and realizing that money to a consideraable amount would be necessary in order to make the work valuable, some future Board of Government will seek an association of treasurers and ask for an alliance between that association and this, for certain definite ends and purposes. It is quite easy to imagine that such an association would have power to levy an assessment of a certain sum per 1,000 spindles represented. This being so, if facts could be placed before them to prove that such an alliance would be useful and valuable, the question of ways and means would no longer give trouble, and work would be laid out somewhat on the following lines: First, permanent headquarters; a secretary giving his entire time to the association and available for statistical and tariff work, as is the secretary of the Woolen Manufacturers' Association; standing committees composed equally of the Association of Treasurers and this Association for the following purposes: First, textile schools. The papers and discussions of to-morrow's session will show the absolute need of these, and how far we are behind England and the Continent. Secondly, arbitration. The State boards of arbitration are a failure because the State has no authority and is put in a ridiculous and humilitating position. Yet arbitration (on all matters save those of principle) is a complete success in many of the manufacturing cities of Europe. Committees made up equally of employers and employees consider all questions of changes in wage scales, and their decision is respected and final. A trial made by this joint association in this respect would do no harm. Thirdly, excessive tare on cotton. This evil grows in spite of all able papers and discussions of this Association, but it could be lessened by a joint association of treasurers and agents. Other matters that could profitably be considered by this alliance would be those points common to all mills, where the field is the same to all,

whether making print cloths or the finest lawns, such as the best methods of making steam, preventing smoke, and utilizing exhaust steam. Sometime in the future some or all of these things will be done.

I wish to thank the Board of Government most sincerely for the hearty support they have given me the past year. The attendance at the Board meetings has been unusually good, the discussions on all points presented have been earnest and full, and the decisions unanimous. In retiring, as I do at the end of this session, from the Board, after six years of continuous service, I wish to thank the members of the Association whose kindness has made my service possible.

The PRESIDENT. The business of this session having been concluded, the Association will take a recess until 2 o'clock this afternoon, and I would ask the members to be here promptly at that time.

Noon recess.

AFTERNOON SESSION,

WEDNESDAY, APRIL 29, 2 P. M.

President GOODALE in the chair.

The PRESIDENT. To-morrow afternoon, through the courtesy of the Honorable JOSIAH QUINCY, mayor of Boston, the Association becomes the guest of the city of Boston in an excursion down the harbor. This afternoon we have the greater pleasure of Mayor QUINCY'S presence with us; he will speak to us in welcome, and I esteem it an especial privilege to introduce to you His Honor Mayor QUINCY. (Applause.)

Mayor QUINCY. Mr. President and gentlemen of the New England Cotton Manufacturers' Association, I was very glad when the opportunity was afforded me of contributing to the entertainment of this Association at its meeting in Boston to embrace that opportunity, and I am glad to know that the city is to have the pleasure of contributing to your information or amusement while you are here, by sending you down the harbor on one of its steamers. I am particularly glad that after meeting at other points, this Association has come back to Boston this year as its meeting place. I feel that the New England section of the country is still entitled to the prominence which it has enjoyed in the past in everything that pertains to cotton manufacture, and I trust that whatever may occur in the way of developing the cotton manufacture in other sections of

the country, we may not lose this prominence in New England.

I was quite struck to find that the object—one of the objects—of this Association is to give its members the benefit of the experience of each of them, and to make common property the knowledge and the experience gained in the technical questions connected with cotton manufacture; that the custom which seems to prevail much more in Europe than it does in this country, of making a secret, to a great extent, of improvements in technical processes, methods of manufacture, it seems to me very gratifying to find an organization of this character, connected with such a leading and important industry as that of cotton manufacturing, which is to listen this afternoon to papers which are designed to give to each of its members the benefit of the experience of all of its members.

I feel very strongly that the future prosperity of New England in the line of manufacturing, both in cotton manufacture and in other branches of manufacturing, lies in the direction of close and careful study of the technical requirements of every technical advance in the art of cotton manufacturing, for it is an art, and in progress along the lines of doing finer work. As other sections, nearer to the sources of the supply of fuel, enabled to command cheaper labor in some respects, coming to the market and taking up manufacturfng industries as the South is largely doing, it seems to me that those who are engaged in similar industries in New England must recognize the fact that in order to hold their supremacy they must put more brains, more skill and more education in the carrying on of the manufacturing business in this part of the country; that as other sections of the country take up and successfully rival us in the coarser branches of the manufacture, our policy should be to advance the finer branches of manufacture, to run on to finer goods; as we feel the competition of other sections of the country upon coarse goods. Anything that tends to promote technical knowledge or technical education seems to me to rank almost first in importance from an industrial standpoint in our section of the

country. And I am very glad that this organization which takes this subject within its jurisdiction, and which is formed for the purpose of advancing the art of cotton manufacturing and of advancing its progress and of spreading technical knowledge, has chosen to meet this year in the city of Boston.

I trust that you will have a pleasant stay here, and that you will have an agreeable excursion down the harbor to-morrow, and that you will return here as often as possible for your future meetings. (Applause.)

The PRESIDENT. In behalf of the Association, I present to Mayor QUINCY our sincere thanks for his courtesy, and I think I can say there is no body of men in all New England who are more interested in maintaining the standard of cotton manufacture in New England than the members of this Association.

I will state the result of the report of the tellers of elections. There were 58 ballots cast for active and associate members, all of which were for those whose names have been read by the secretary, and I declare the same elected.

The following papers were read and topical questions dis cussed.

"Dobby and Jacquard Weaving," by Mr. GEORGE W. STAFFORD, Providence, R. I.

Topical Questions.

4. What is the best motion for weaving Jacquard patterns, single or double action machines?

5. Do weavers run as many looms on Jacquard as on dobbies?

6. Is it profitable to use dobbies for over twenty harnesses, or is it better to use Jacquards?

7. Ought a manufacturer to receive more per pound for goods made on Jacquard looms than on dobby looms, both using same numbers; sley and picks being the same?

9. Is it advisable for manufacturers to run looms on fine numbers at the same speed as on coarse numbers?

"Weave Shed Construction," by Mr. JAMES R. MACCOLL, Pawtucket, R. I.

Topical Questions.

10. Why is the over-pick so universally used in English looms, and the under-pick on American looms?

15. In the construction of a weave shed is it best to provide a basement for shafting and other uses, or is it best to dispense with a basement and drive the looms from shafting over head?

"The Northrop Loom," by Mr. FRANK M. MESSENGER, North Grosvenor Dale, Conn.

Messrs. H. D. WHEAT of Gaffney, S. C., and J. H. HINES of Burlington, Vt., gave their experiences with the Northrop loom.

Topical Questions.

3. Will the new Draper loom require more repairs than an ordinary loom, both being run at the same speed? If so, how much will these repairs add to the cost of cloth made on the Draper loom?

18. Can the Northrop loom be run profitably at the same speed on print cloths as the Whitin loom?

"Cotton Manufacturing in Switzerland," by HERR TH. OTTO SCHWEITZER, Frauenfeld, Switzerland.

Topical Question.

8. How many looms do Swiss cotton weavers run on fancy weaving, either Jacquard or dobby? Also, what numbers of warp and filling in same with speed of looms?

"Tests showing power required to drive various widths and makes of looms," contributed by various members.

MORNING SESSION.

10 A. M. THURSDAY, APRIL 30, 1896.

President GOODALE in the chair.

The PRESIDENT. The first business this morning is the election of officers, and I will appoint Mr. HERBERT FISHER and Mr. J. H. HOWARTH as tellers to receive, distribute and assort the ballots. The ballots were printed in accordance with the report of the committee yesterday.

Have all voted who wish to? if so, I declare the ballot closed.

The report of the tellers will be made at the close of the meeting.

The following papers were read and topical questions discussed.

"Textile Education in the Manufacture of Textiles," by Mr. EDWARD W. FRANCE, Philadelphia, Pa.

"Public Textile Education in Massachusetts," by Mr. FRANK P. BENNETT, Boston, Mass.

Topical Question.

2. What benefit will the people of the State of Massachusetts derive by the establishment of textile schools?

"The Future of Cotton Manufacturing in the South," by Mr. D. A. TOMPKINS, Charlotte, N. C.

Topical Questions.

1. How many ends per thousand spindles should be allowed to be broken down in a spinning room where the roving is furnished well prepared and the yarns vary in numbers from 20 to 80?

11. What means can be used to prevent the formation of anchor ice?

12. What can be offered on the subject of the influence of moisture in the air affecting the strength of yarn? [No discussion.]

13. What is the quantity of steam properly required for slashers and the best means of applying the same?

14. What steam pressure should be carried on slashers running on colored work, and what is the best means of returning to boilers the condensation from slashers?

17. Can cotton manufacturers do anything more than they are doing at present to prevent the recurrence of boiler explosions? Will the new Massachusetts law which went into effect August 1, 1895, requiring the examination of engineers and firemen, help materially in this direction?

Mr. WALTER E. PARKER. I believe the Board made no mistake in selecting Mr. EDWARD W. FRANCE and Mr. FRANK P. BENNETT to present the question of textile schools. The question is very timely, and I have been exceedingly interested in listening to what they have had to say. I want to move you that a vote of thanks of this Association be passed to those gentlemen.

It was moved and seconded that a vote of thanks be passed to the two gentlemen for their interesting and instructive papers.

Mr. GEORGE W. WEEKS. I move that the thanks of this Association be tendered to the City of Boston for the generous invitation and provision for the excursion down the harbor by the courtesy of His Honor Mayor QUINCY and Dr. ALFRED B. HEATH, Commissioner of Institutions.

Motion passed.

The PRESIDENT. The report of tellers of election gives the result that the following officers received all the ballots, and I declare that they are unanimously elected.

President, ARTHUR H. LOWE, Fitchburg, Mass.

Vice-Presidents, WILLIAM J. KENT, New Bedford, Mass; FRED C. MCDUFFIE, Boston, Mass.

Directors, one year, to fill vacancy, RUSSELL W. EATON, Brunswick, Me.; *three years*, ALBERT F. KNIGHT, Adams, Mass.; JOHN ECCLES, Taftville, Conn.

The PRESIDENT. I will ask Mr. PARKER, a past president of the Association, to escort Mr. LOWE to the platform. (Applause.)

Mr. ARTHUR H. LOWE. Mr. PRESIDENT and members of the New England Cotton Manufacturers' Association. I certainly thank you most sincerely for the honor which you have conferred upon me, and feeling as I do, that there are other members much better fitted, both by their technical knowledge, and by their acquaintance with the membership of the Association, to assume the responsibilities than I am, I accept the responsibilities jointly with you, for the responsibilities of this Association are certainly as large, as the industry represented is important. You will hardly expect me to give you any policy or platform at this time. I most heartily endorse and subscribe to the platform and suggestions which were given to you yesterday by your retiring President. I would only add to those suggestions that in my opinion this Association should become the "American" Cotton Manufacturers' Association, instead of the New England Cotton Manufacturers' Association. I think its field should be broadened and its scope extended. At this time I want to acknowledge to you my appreciation of the efforts of your retiring President. The year closing with his administration will be a standard in the history of this Association. He has devoted untiring efforts; he has given us a great deal of thought and work, and you have the results before you in the increased membership and in the

increased influence of the Association. I am sure if I shall be able to accomplish such results as he has accomplished, or such results as have been accomplished by his predecessors, at the end of the year, I shall feel that I am entitled to the commendations of the membership of this Association. Thanking you again for conferring the honor upon me, I declare, unless there is other business, that this annual meeting is now dissolved.

Adjourned.

C. J. H. WOODBURY,
Secretary.

The afternoon was devoted to an excursion down the harbor of Boston in the steamer J. Putnam Bradlee, as the guests of the city of Boston, through the courtesy of Hon. JOSIAH QUINCY, Mayor of Boston, the representative of the municipality on the boat being Dr. ALFRED B. HEATH, Commissioner of Institutions. The party made a stop at Moon Island where the operation of the sewage disposal works of the city was exhibited for the benefit of the party. A lack of time, owing to a desire of the members to leave by early afternoon trains, prevented the party from availing themselves of the opportunity of accepting the invitation of the city to visit other public works of interest.

TRANSACTIONS.

AFTERNOON SESSION, 2 P. M., APRIL 29, 1896.

Chipman Hall, Boston, Mass., meeting called to order. President GOODALE in the chair.

The PRESIDENT. In looking over the records of the Association, I do not find any papers in the past relative to dobby and Jacquard weaving, and as this branch of the business has assumed very large proportions in the past few years, the Board of Government has asked Mr. GEORGE W. STAFFORD to treat the same, which he has kindly consented to do. I have much pleasure in introducing Mr. STAFFORD. (Applause.)

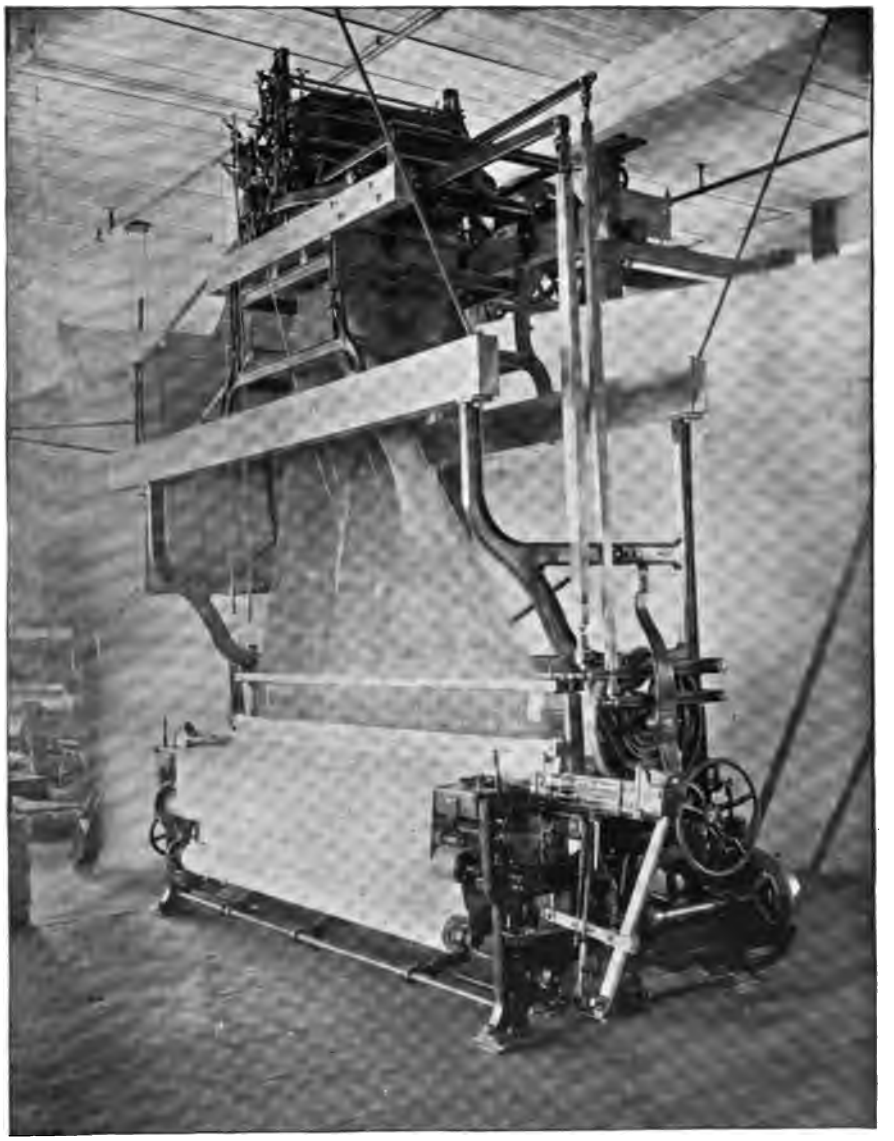
DOBBY AND JACQUARD WEAVING.

MR. GEORGE W. STAFFORD, Providence, R. I.

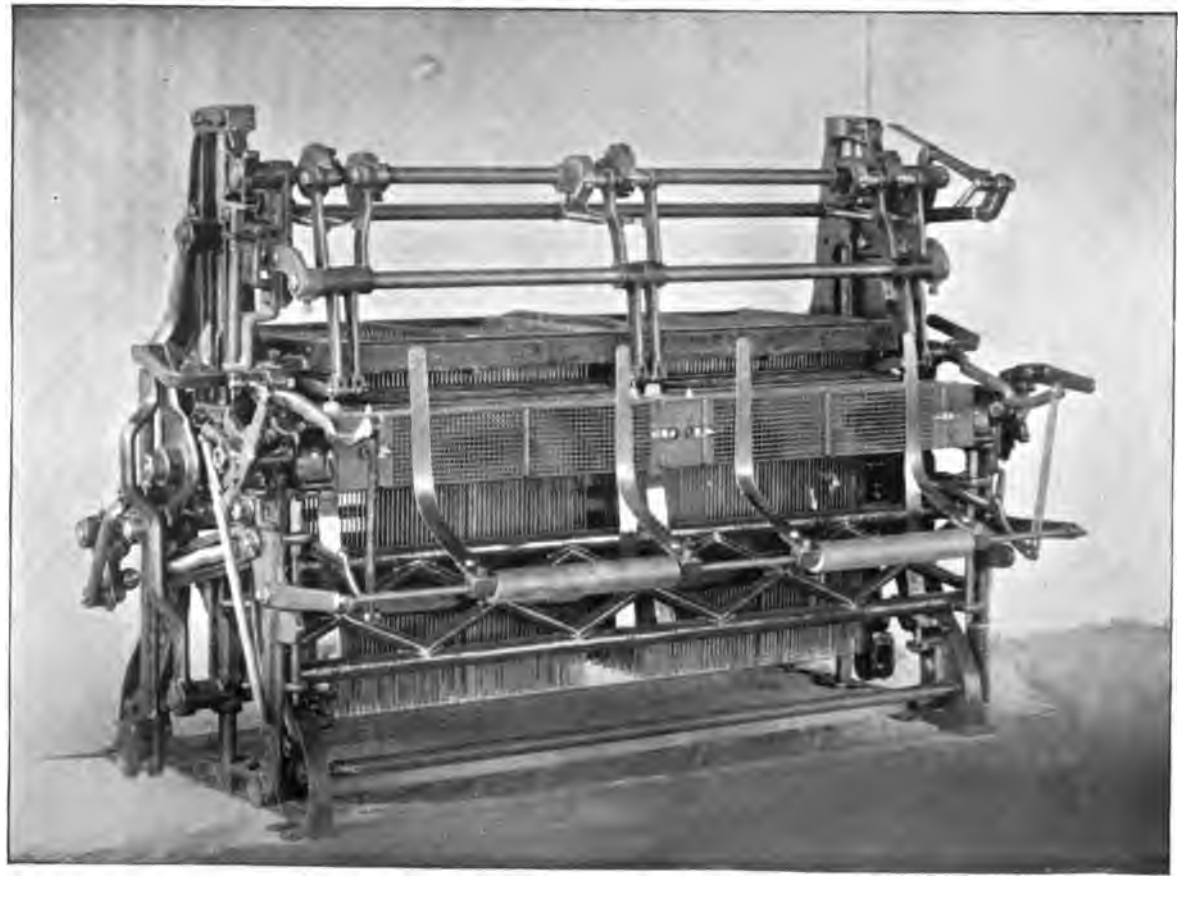
The magnitude of the subject allotted to me can be but imperfectly presented in the time in which such a paper must necessarily be confined. The introduction of fancy weaving machinery has received much attention during the last ten years. Mills constructed originally for the production of plain cloths only, have changed many of their looms either by the addition of dobbies, Jacquards or box motions, to be able to weave figured or colored effects. The mills in the city of Fall River are good examples of this fact, originally designed almost wholly for print cloth, they have in many instances changed the machinery until now almost every class of white cotton fabrics are manufactured. Many thousands of looms have been changed to fancy until there are but few, comparatively speaking, that

cannot produce almost any special fabric the market may demand. It would seem that all mills projected in the future might find it advantageous to so equip these plants that a change from a plain to a full fancy could be readily accomplished. This can be done, and after the change is effected the plant should be in as good shape as a mill originally designed for fancy goods. Of course to do this the engineer should see that the lay out of the plant was such that this could be done without contracting the space about the looms required for the operator. In many cases it is found that the application of a dobby leaves no alley room to speak of, for the reason that the dobby sets shoulder high, so to speak, yet does not project beyond the end of shuttle box. Further, by the addition of a box motion for using two or more shuttles more space is required, as the box end in which the drop box is operated requires to be several inches longer than an ordinary plain shuttle box. Further, in the production of leno effects, as explained elsewhere in this paper, it becomes necessary to place additional beams of yarn at the back of the loom; while they may not project beyond the ordinary beam, still they contract the space which the operators require to properly handle the work. In addition to the beams there are additional whip rolls or their equivalent, also slackness, so called, all of which are necessary to the production of the goods, and all of which require room that unfortunately is too often lacking.

For the introduction of Jacquard weaving attention should be given to the height of the room, and also to the light, the harness having a tendency to cut off the light, especially where the looms are set as they generally are, in a direction with the length of the mill. In such cases the weave shed style of construction is of very great advantage, in fact it is in the judgment of the writer preferable in all cases — better light, ventilation, etc.,— all of which tend to better products in the majority of cases; however, the builder of Jacquard machinery is confronted with low-studded, badly lighted rooms, often so low as to raise a serious doubt as to the result upon the harnesses,



Marseilles Quilt Loom.



owing to the increased angle given to the sides of harness under such conditions. There are so many points requiring attention in order to install and successfully operate this class of machinery, that a competent person should be consulted regarding the difficulties herein alluded to, and thus avoid being compelled to sacrifice speed and productions as compared to a more fortunate neighbor with a modern plant. There are many who look upon the Jacquard machine as of such a complicated nature that the advantages are barely looked into, yet the improvement in this class of machines keeps pace with the improvements in other classes of machinery, hence we are able to successfully operate at a speed that ten years ago would have seemed out of the question. We are not advocates of high speed. Too many things are to be considered in this connection of greater moment than the construction of the mechanism. Machines of four hundred hook capacity, forty-two inches of harness in width, are in some cases run at a speed of one hundred fifty to sixty per minute (rise and drop machine) this compared to speed possible to obtain by such a machine as used by Jacquard, which usually did not exceed sixty or eighty per minute, shows a decided advance in improved constructions.

A Jacquard on the plan that was in use by Jacquard is known as the "knot-board" machine, and is quite generally used at the present day, principally in the carpet trade for the production of ingrain. This style of machine has been used for Marseilles, but has been superseded by a later machine shown in Fig. 3, having all the advantages of the knot-board, and the additional advantage of more rapid work and greater durability. This machine is of the rise-and-drop-type, and has features that dispense with the so-called "plain card," using only the figure card.

The Marseilles weave as generally used may be of interest. I will as briefly as possible explain the action of the loom and Jacquard for the production of this weave. Two warps are used, a coarse und fine; the coarse being the figure warp, and the fine the face or ground warp. The fine warp is operated by ordinary harnesses in front of the Jacquard harness; two shut-

tles are used, one for the fine face fill, the other for the coarse or backing fill. In operation, the Jacquard (the hooks being operated by the figure card) rises, opening the shed, and remains up, or shed open, for three picks, then falls, immediately rises, lifting half of all the hooks, and necessarily half of all the warp threads operated by it. One pick is here thrown of coarse filling for the backing. It again falls, and on this movement a figure card is again presented to the needles, and a figure lift produced to remain up as before. During this action of the Jacquard the plain harnesses are working, weaving plain, as follows: First pick, all face warp in the upper shed; second pick, half of the face warp descends to the lower shed or bottom; third pick, bottom shed rises and top descends; and on the fourth pick, all warp is again raised to the upper shed and then repeats. The action of the filling during these movements is two picks of fine on face, and one each of fine and coarse to the back. There are other methods of Marseilles weave; that herein given is the one most generally used.

Before the introduction of the plain card attachment shown, it was customary to use a card wfth perforations for every alternate needle, by this means operating one-half of all the hooks in the machine. The use of this card necessitated that the cylinder be presented to the needles on the third and fourth pick, whereas, by the use of this attachment, the cylinder is so presented only on the fourth pick, hence a large saving in cards and necessary wear and tear on the mechanism.

Fig. 4. Shows a Jacquard such as is generally used for dress goods or similar productions. In the use of this class of machine the simplest form of weaving figured goods is obtained. This statement may be questioned by some, but when considered in the light here given, you will, I think, agree with me. First, it is possible with the machine here shown to run the loom as many picks per minute as a loom should run on fancy goods, say 155 to 160 picks per minute on 40″ goods; secondly, without change of warp, hundreds and thousands of different patterns may be woven, it only being necessary to change the cards

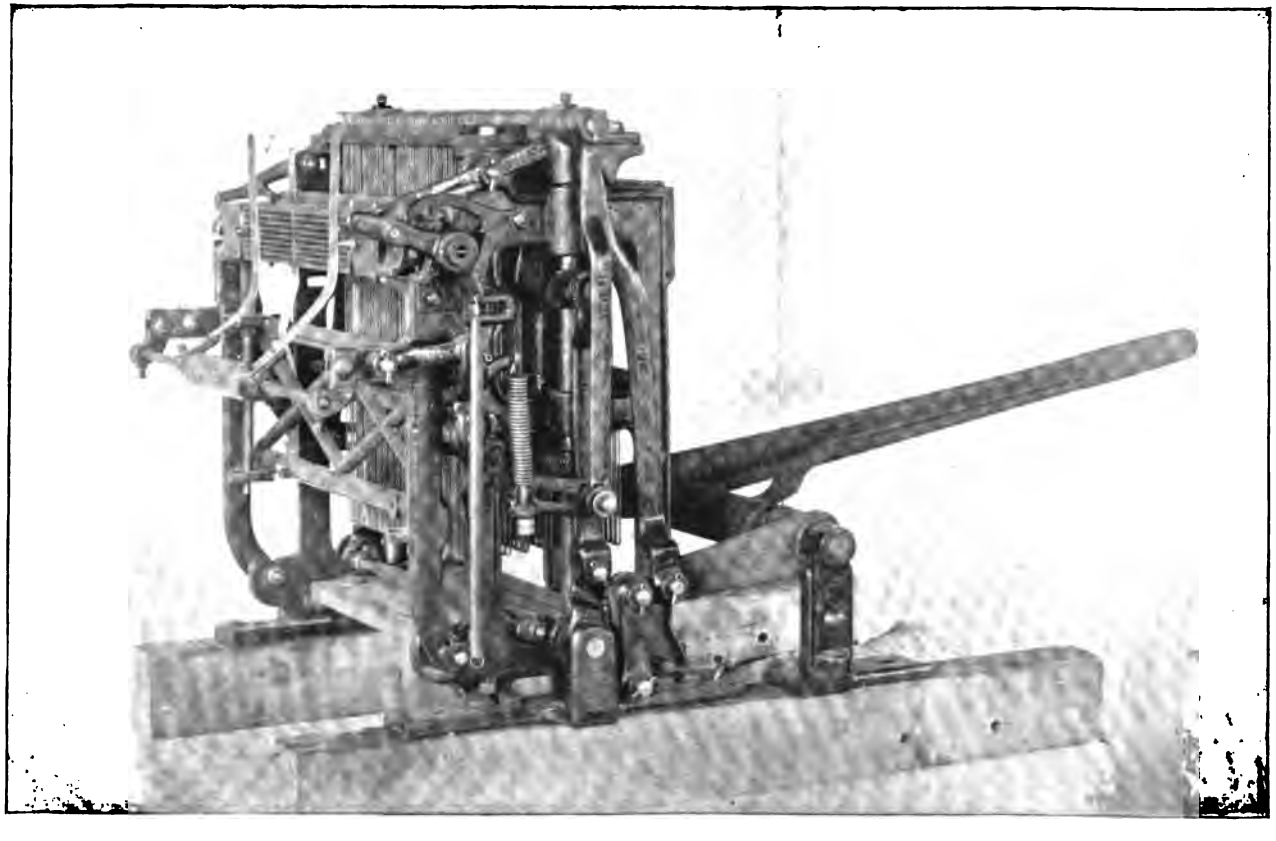


Fig. 4.—Rise and Drop.

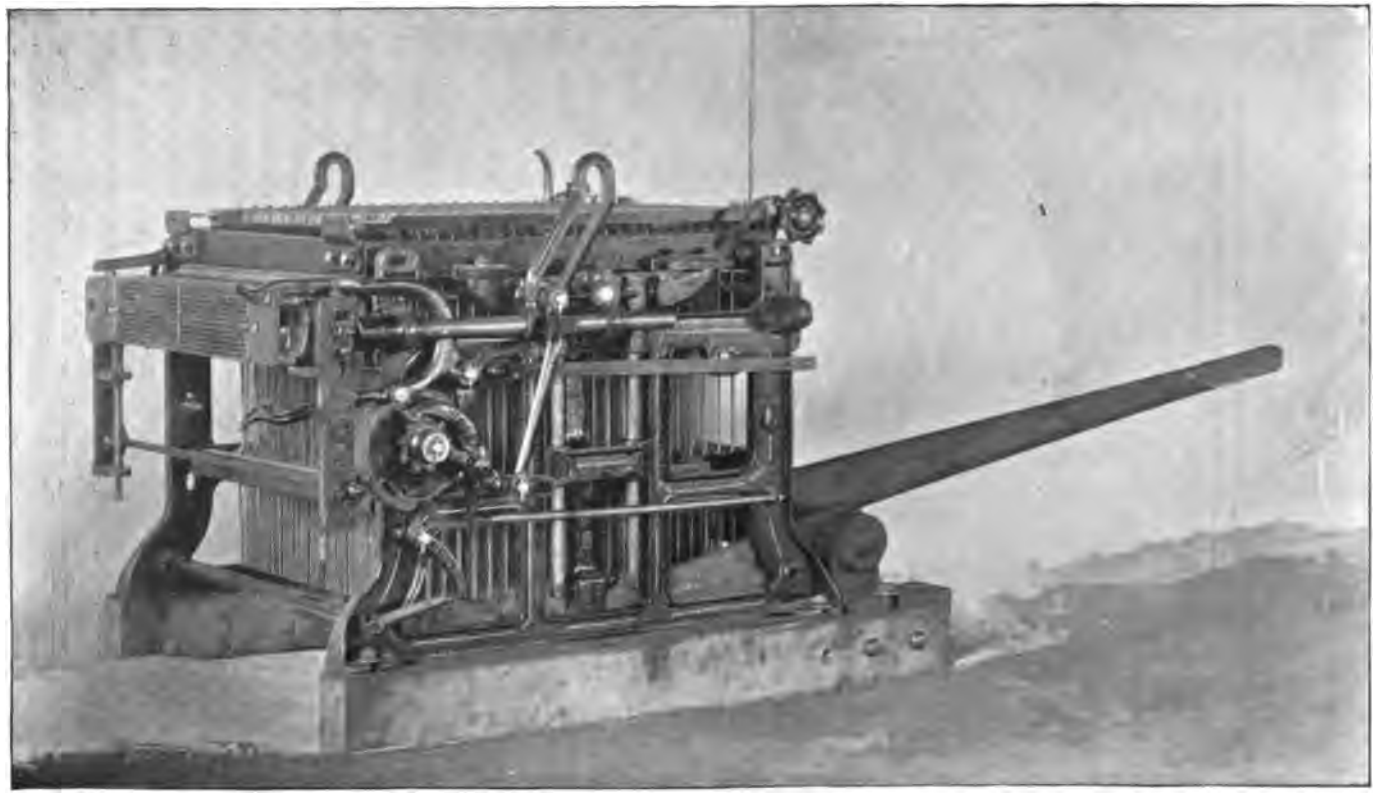


FIG. 5.—TWILL MACHINE.

on the cylinder; again, when new warp is needed it is twisted on to the old, which can be done in from one to three hours, depending on the number of ends. The life of the harness is with proper care three to six years; we have record of many that have run continuously for eight years, and in this connection it is well to say that the life of a harness decreases as it increases in width, owing to the angle of the outside threads; for this reason, it is desirable on wide harnesses to set the machine at a greater height,—in some cases as high as twelve feet from the floor is desirable.

Fig. 5. The style of machine here shown is known as a "twill" machine, and is used where large figures are desired, a 600-hook of this class producing figures as large as 1200-hooks of ordinary construction; it also affects a large saving in cards because as arranged it will weave the twill ground without any cards, hence a new card is not brought into contact with the needles except on the second and third pick, as the case may be, or as the pattern may require. This class of machine is well adapted for producing satin quilts, so called, that are at present meeting with some favor, and which require from 2,000 to 3,000 hooks or more. Various forms of Jacquard harnesses are employed, the "Compound," so called, being arranged with point draft from the centre each way, and in addition a border harness at each side to weave borders independent of the body or centre of the goods. In silk, shaft harnesses are used quite generally, and by this means are obtained many of the advantages found in this class of Jacquard here illustrated.

Fig. 6. This illustration shows one method of adapting shafts to a Jacquard harness. These are thin strips of wood passed through the cords, and have attached at each end cords, which are in turn connected with hooks in the Jacquard machine, and when these are required to be used, the shaft in lifting carries up a whole row of the cords attached to a row of hooks in the machine. By this means satin grounds can be woven with a very hooks, thus leaving vacant, so to speak, a large per

cent. of the hooks in the machine to be utilized solely for figuring purposes and thus produce a much larger figure.

I shall not attempt, nor would it be possible to give, a thorough explanation in this paper of all or even a small part of the possibilities of this machine. The mind can hardly conceive of anything that cannot be reproduced true to life or figure by the use of such a machine with proper material.

In passing I think it may be interesting to note that the impression generally prevails that the principle involved in the Jacquard machine is the invention of Jacquard; such, however, is not the case, if current history is to be believed. In 1725, M. Bonchon invented the application of perforated paper for working a draw loom, this being the origin of the Jacquard machine. Jacquard, however, was a clever mechanic, and was successful in making the device mechanically perfect; it is this device in all essential particulars that we use to-day.

Fig. 6 A. Dobbies or harness shedding motions. In this connection I shall confine myself to a description of a machine first introduced by Hattersley of England. All double-action dobbies of the open shed type are copies or modifications of this particular invention. Its action upon the warp is such as to commend it to the judgment of every person familiar with shedding, and its use has served to materially decrease the cost of producing what are known to the trade as "dobby effects." It is susceptible of producing a very wide range of patterns and can be used in various ways for the production of leno or gauze effects, either as a single acting machine or by the application of various devices that shall govern the doupe harnesses independent of the pattern mechanism of the dobby, or, as will be illustrated, by device attached direct to the dobby governed by the pattern mechanism.

By this latter means it is possible to run the dobby open shed and produce perfect leno. Ordinarily the leno weave requires a close shed mechanism to produce it. The action of the doupe in passing from one side of the ground thread to the other re-

FIG. 6—SHAFT HARNESS.

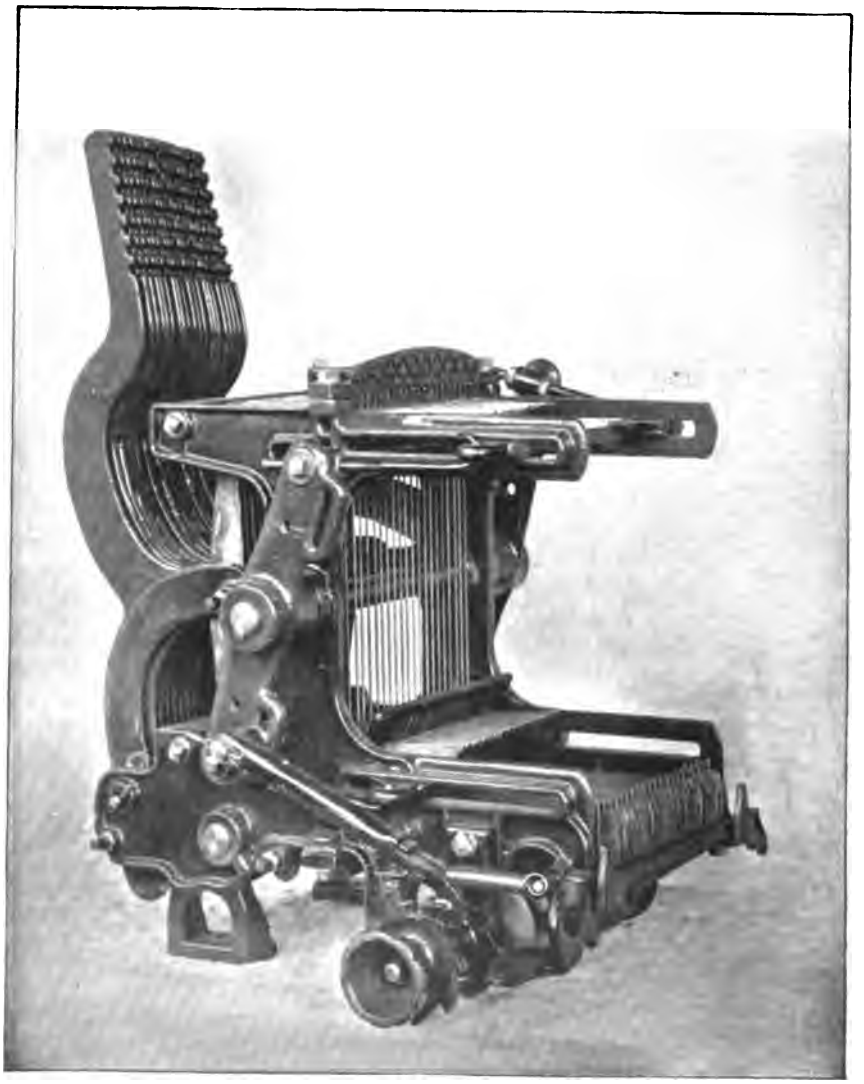


FIG. 6 A.—DOBBY.

quires that the ground thread should be in a state of comparative rest, and slightly above the lowest position of the doupe while it is passing from one side of the thread to the other; in weaving open shed leno, therefore, it becomes necessary to operate the doupe and standard harnesses, together with the harnesses containing the ground threads, in such a manner as to obtain the same conditions for crossing the doupe as obtained in the close shed mechanism, hence the peculiar action of the appliance known as the leno attachment to the dobby.

Fig. 7. This illustration shows a dobby with leno attachment upon it. It will be observed that there are three knives or lifters; the lowest of the three and the one directly above it are the regular lifters such as are found in all machines of this class, and these are used in the leno dobby precisely as they are used in any dobby, i. e., to weave the body of the goods. The leno lifter has a movement a little more than half the distance of the regular lifters, and makes an outward and inward stroke for each revolution of the crank shaft; and therefore, while either one of the regular lifters is raising a harness from the lower into the upper position of the shed for the passage of the shuttle, the leno lifter can raise a harness a little more than half way and then return it again into the lower position, completing the return at the same time that the regular lifter completes the raising of the harness. This is the half and return motion so-called, as applied to the harness containing the ground threads. The half and return motion as applied to the doupe which contains the whip thread is obtained by means of a forked strap, or other equivalent, connecting two of the harness levers of the dobby to the slip shaft of the doupe. (The standard heddle shaft is connected to the dobby in the usual manner.)

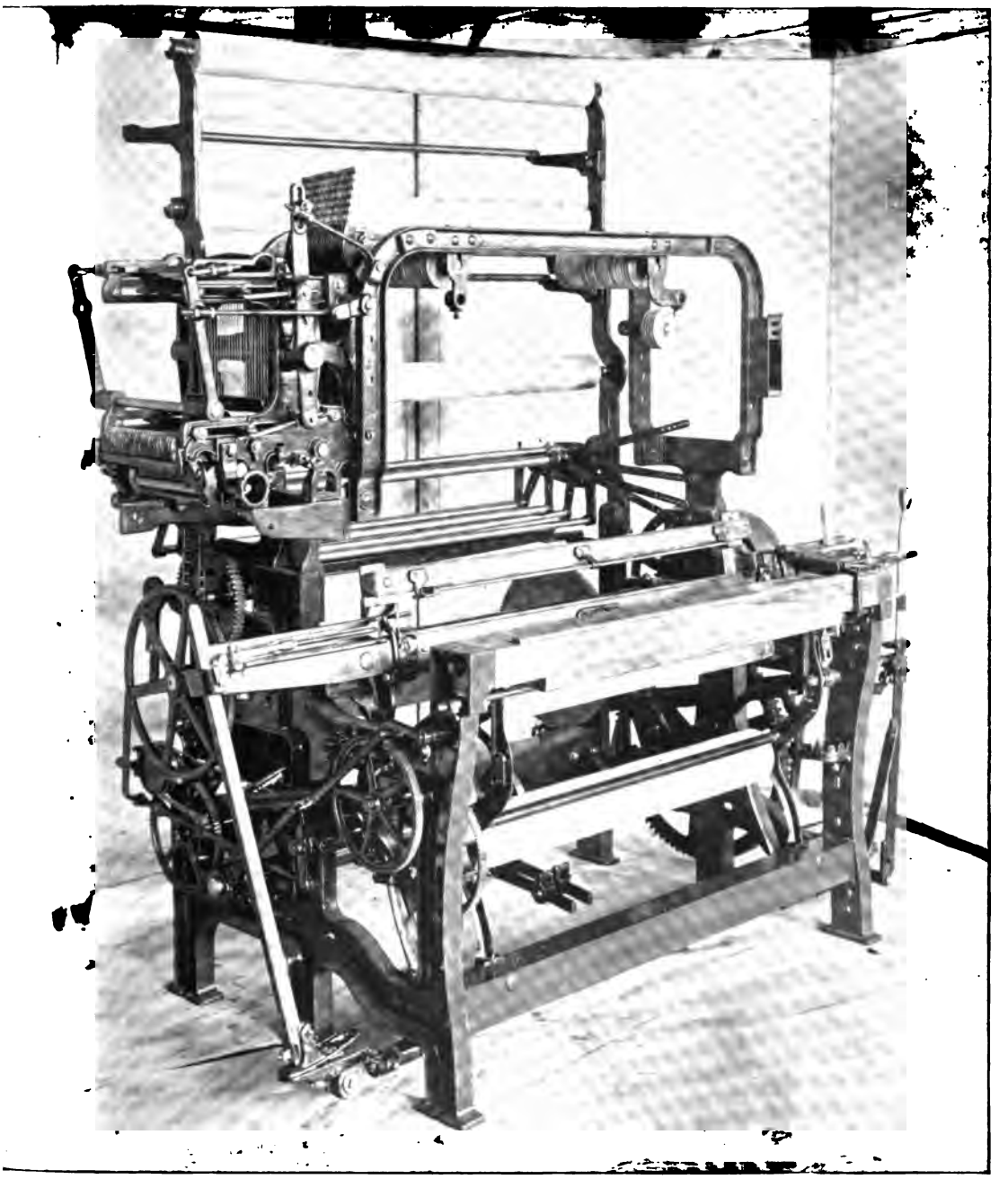
By operating the two doupe levers simultaneously in opposite directions, it will be seen that the doupe shaft attached to the forked strap connection, and in the position of the upper shed, would be lowered by the inward movement of one of the doupe levers to a point where the the two levers meet, or about mid-

way of the stroke; and then by the action of the other lever moving outward, would be returned to its position in the upper shed. You will observe that this operation lowered the doupe only half way and then returned it, performing a half and return movement but in the opposite direction from the one performed by the leno lifter on the ground thread. By the combination of these two half and return motions the leno operation is effected.

When the pattern requires the twisting or crossing of the threads the leno lifter engages one of the upturned hooks shown, which through its connections, raises the ground thread. At the same time, one of the two doupe levers commences to lower the doupe containing the whip thread. At the same time also, the other doupe lever commences its outward stroke, and the standard heddle also commences to raise by its connection to a regular lifter. These movements continue until the leno lifter has completed its full outward stroke, and the two doupe levers are in line with each other in the position about mid-way of their stroke.

At this point the ground thread has been raised to a position a little above that of a centre line drawn through the centre of the shed, and the doupe and standard have brought the doupe and whip thread to a position as shown by the centre line or just a little below the ground thread. In this position the doupe and whip thread may pass from one side of the ground thread to the other side, thus affecting a twisting of the threads half way around each other, and by both return movements before described, the ground thread may be returned to the lower, and the whip thread to the upper shed for the next passage of the shuttle. The operation of twisting or crossing the threads may be effected after every pick of the shuttle, or varied as the pattern may require. The operation of the half and return movement of the ground thread is indicated from the pattern chain of the dobby by a special arrangement of the pegging.

The combination of pegging to operate this arrangement for



doupe weaving, for convenience in remembering, is classed as containing three elements, viz., a long peg, short peg, and no peg. When the finger governing the leno hook has no peg under it, the hook is brought in contact with the upper of the three knives; when a short peg comes under the finger, the effect is to bring the hook into a neutral position where it will not engage with either of the two knives adjacent to it; when a long peg comes under the finger, the hook is brought in contact with the lower one of the two knives, and the harness governed by it is thus brought into the regular shed producing its effect upon the ground of the goods. It will be seen from this that the doupes are only acted upon for douping purposes when they are required, and at other times may be acted upon in the ordinary way as the threads governed by them are woven into the ground of the cloth.

There are other forms and attachments for open shed leno weaving, one of which is known as the "breaker cam"; just how that term is derived I am in doubt. The use of this cam, which is a double cam running on the bottom shaft of the loom and gives a movement to the doupe harnesses at every pick of the loom, serves to keep them in constant motion whether they are required or not for douping purposes; they are constantly moving up and down at every pick of the loom. The modification of breaker cam consists of a roll mounted over the dobby frame having an oscillating motion, which in turn is connected to two of the levers of the dobby, on which levers the doupe and standard harnesses are also attached; the action of this being to bring one lever up and allow the other corresponding one to descend, and vice versa at each pick of the loom. It is manifest from this explanation that leno can be woven on plain cam loom with similar appliances to those herein enumerated, provided of course nothing is wanted in the ground other than plain cloth or leno effect.

Fig. 8. As the question is often asked how the warp threads are drawn into the leno weaves of this description, there is shown

here on a large scale the method of arranging the doupe and the doupe heddle; also the doupe thread and the thread that passes over the doupe. In the illustration the thread No. 1 is the doupe thread, and No. 2 the thread that passes over it. It will be noted that the warp thread which may pass through heddles in the ground harnesses is also drawn through a doupe, and in connection with that thread No. 2 passes through the eye of one heddle, and is drawn directly over and across the doupe thread, passing between the first heddle of the doupe thread, and the standard or doupe heddle. In open-shed dobbies the harnessess meet and pass each other in rising and falling at half stroke, that is to say, when the one is half raised the one descending is half way down; in consequence of this, no harness can both rise and fall in the same pick or beat of the loom. This rise and fall in time equal to one pick of the loom is necessary to weave a half turn leno, so called; or, in other words, a half turn twist of the threads No. 1 and No. 2, between two successive picks, hence, the reciprocation of the knife as above explained, is made to give a forward and backward movement in time ordinarily required for one pick.

In operation we will suppose that No. 2 thread is at the lowest point in the shed, and it is desired to cross thread No. 1 under it. We lower thread No. 1 to the centre of the shed and raise No. 2 to a corresponding point, and by the action of the slip shaft carrying the doupes the thread governed by the doupe is drawn from one side of the thread to the other, the harnesses immediately separate, and we have the cross in the thread. It is manifest that on a repeat of this movement the thread will cross to the other side, and it will be observed by examining this weave that that is what the half-turn leno consists of: the thread is first thrown to right and then to left, and vice versa. As a pick is thrown also after each movement of this kind, the effect is to give the appearance of the threads wound half-way around each other.

In weaving lenos where the thread producing the leno effect

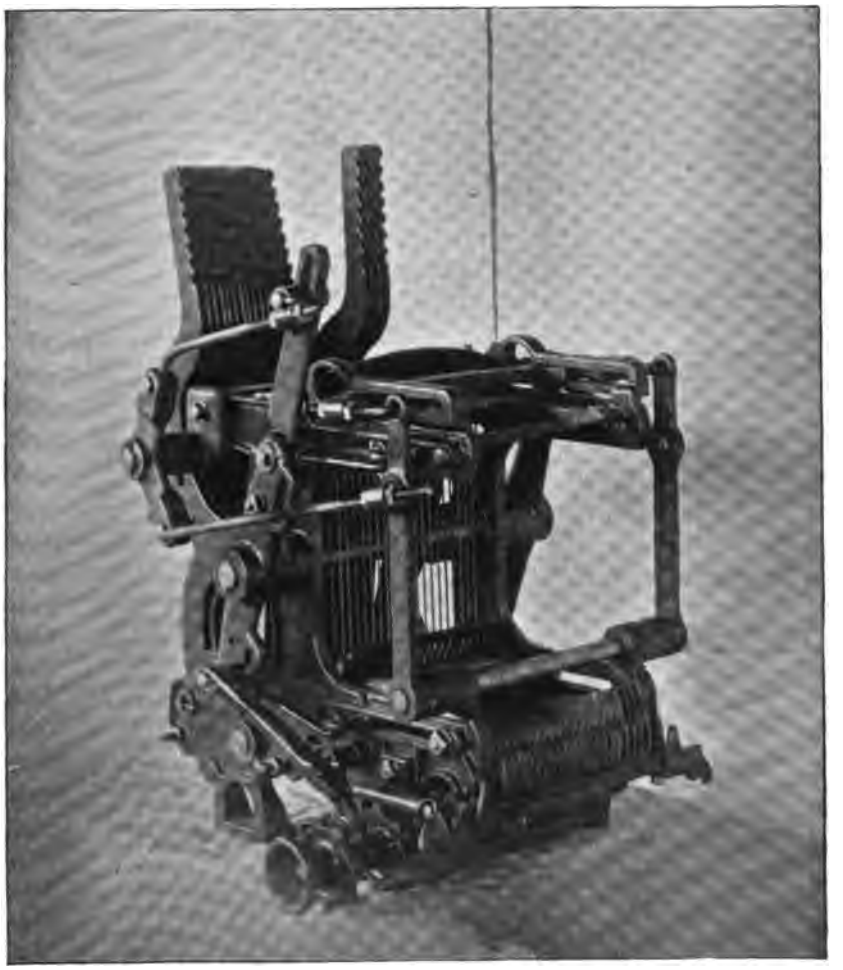


Fig. 7.—Leno Dobby.

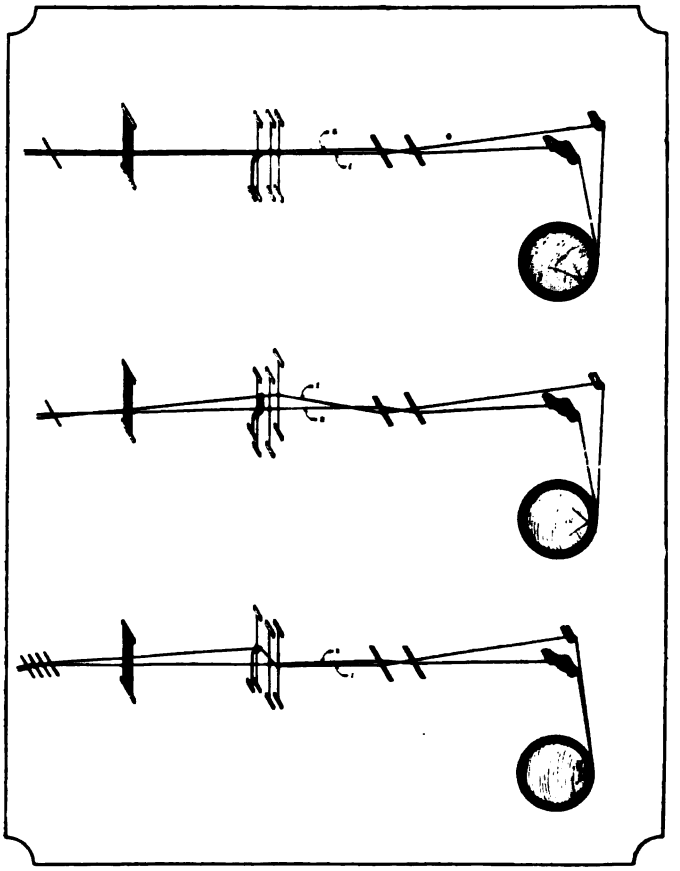


FIG. 8.—LENO DRAFT.

is of a coarser texture than that of the warp threads, it is advisable to run these on a separate beam and there are cases quite common where three or four additional beams are used on one loom for the purpose of making as many different doupe weaves in the goods. The doupe thread as it twists around the other thread has a tendency to take up more rapidly than the regular beam; in other words, it consumes more yarn in the length per yard of cloth than the regular beam, hence it is desirable in almost every case to run it on a separate beam. This, however, is not always done, certain goods working very well where a single doupe is used all working from the same beam. Where a number of different weaves of leno are woven at the same time, as many different doupes as there are different leno weaves are required, and a repetition of the one here shown is necessary as often as the different weaves appear.

An important element in leno weaving, not yet explained, is what is termed the doupe slackener. This consists of various devices applied at the back of the loom over or near the usual whip roll, or vibrating bar. These slackeners are operated by the dobby motion, or may be attached directly to the doupe harness. It is manifest that as the dupe itself is made of a worsted twine that the warp would have a tendency to cut them rapidly as well as break the warp threads, were it not that at the moment the doupe is acting upon its thread the slackener yields, slackening those threads only that are acted upon by the doupes, and as soon as the doupe has completed this movement the slackener returns to its normal position tightening up the doupe thread to be sure of its weaving at the proper tension to make a perfect appearance in the cloth.

Fig. 9. The double-acting Jacquard was invented by ALFRED BARLOW in 1849. This machine, for certain classes of goods, is of great advantage, in that it enables the loom to be run at a higher rate of speed, is easy upon the warp, and for upholstery and similar goods is in quite general use. There is one peculiarity found in the action of this machine: on light weight

goods having large figures, or light and heavy lifts, it will at times cause a mark to show in the figures, owing probably to the action of the warps passing each other at the time the lay is beating up. For this reason they are but little used in the silk trade, and rarely in cottons such as are generally produced in New England. The machine here shown has two banks of needles and two cylinders, the alternate cards upon one cylinder and even upon the other. The action consists of an alternate movement of the cylinder at each pick of the loom. There are other forms of this machine using but one cylinder; the class here shown is, I think, preferable.

Fig. 10. The fine index machine here shown has come into favor recently. Although not new, it was not thought practical, owing to the fine adjustment required; this, however, is not a serious difficulty. The method employed in construction is such that when the cylinder is once adjusted to the needles, very little, if any, danger exists of a misspick from false indication. The machine shown has 1,304 needles, 16 rows deep; to give a good idea of the size of the machine, Fig. 11 shows two pattern cards; one of a 600 French index, such as is in general use, the other a fine index card of 1,304 hooks. You will at once see from this that a machine of large figuring capacity can be had in a small space by the use of the fine index.

Of the different classes of Jacquard machines now on the market that which has been received with the greatest favor for all classes of work is known as the "Stafford" single-lever rise-and-drop. No machine of this class has met with such ready sale or received so many repeat orders. I have in mind at this writing several mills from whom repeat orders up to eight, covering several hundred machines. Usually a repeat order is conclusive evidence that the device is all that is claimed for it. The writer hopes this allusion will not detract from the maiden-like modesty with which he is generally reputed to be so richly endowed, particularly when it is acknowledged thus publicly that whatever inventive faculty may have been shown, or ability

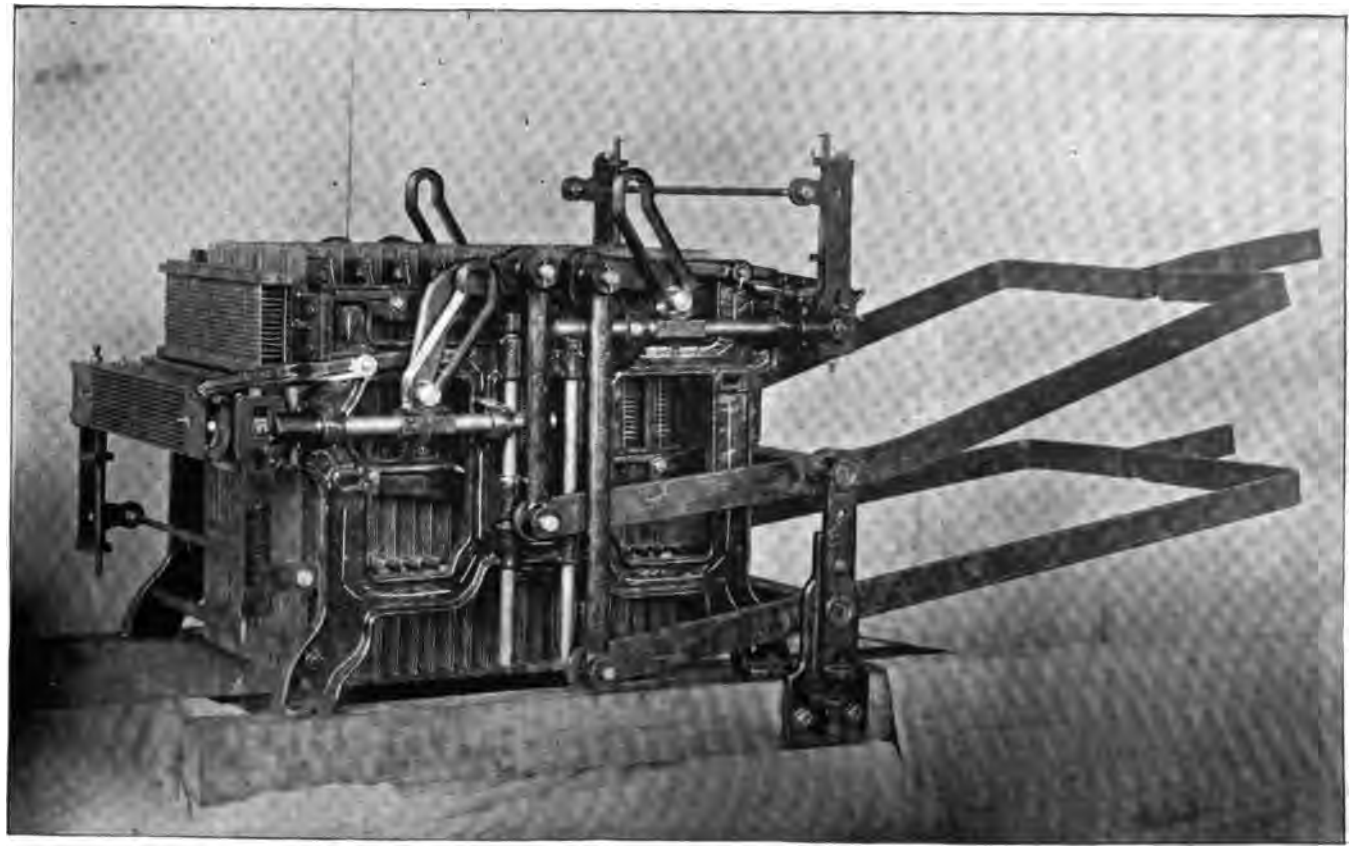


Fig. 9.—Double Action Double Cylinder French Index.

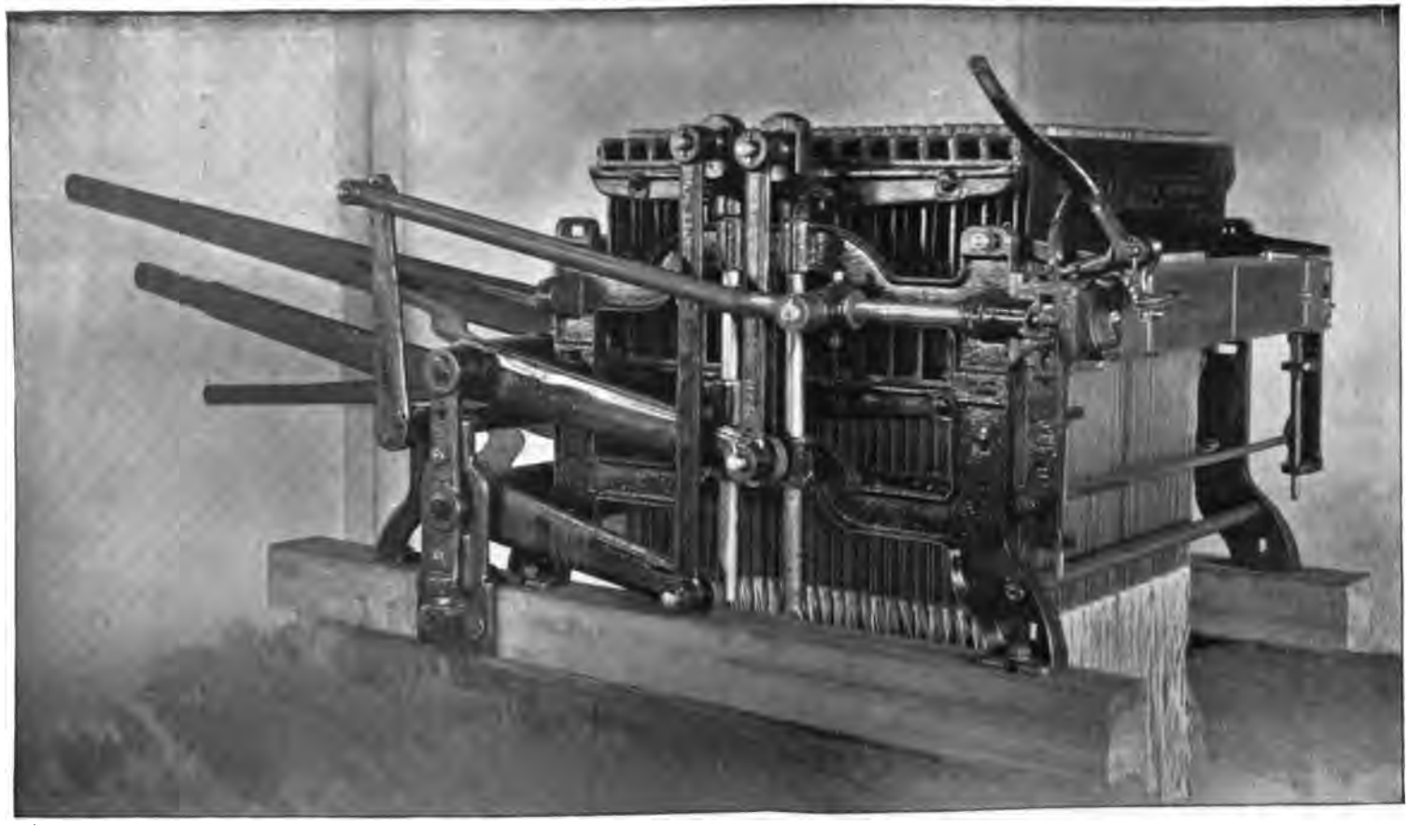


Fig. 10.—Fine Index Double Action.

of any nature possessed, would surely have come to naught were it not for the generous support from many gentlemen of this Association, for which I am truly grateful.

Fig. 12. Lappet loom. At the present time much attention is being given to the production of lappet goods, so-called from the nature of the fabric, it being usually a plain ground having certain threads and cords lapped under and over certain of the warp threads. The order in which the needles carry the cords are moved determines the figure, the latteral movement of any one set of needles being necessarily limited to that portion of the figure to be formed by its frame, and a multiplication of frames up to four (as at present employed) serving to make quite an extensive figure. In looms of this class as at present constructed there is no economy in attempting to use them for other than that for which they are arranged; this in answer to the oft-repeated query, Can the loom be used for all kinds of work if lappet is not wanted?

In constructing looms of this class it is found desirable to use a longer sweep to the lay in order to obtain room for the needle frames which must be in front of the reed, and the greater the number of frames, the greater the throw required. This in itself would deter a person from attempting to use the loom on general work; it is also necessarily reduces the speed. Beware of any who talk high speed for a lappet loom; look solely to the production. The speed that will give the most yards will not be a high speed. The Scotch, who seem to be the pioneers in this class of goods, run a 40″ loom at one hundred twenty picks, claiming a better result than at a higher rate.

The loom here shown has many features that are new, but as a whole follows generally the Scotch method. In this there has been no attempt to make a radical departure from well known principles, but rather the incorporating of several well known devices that produce a combination that has met with extraordinary sales for a novelty mechanism. You will note that the cranks are placed at the outside of the loom; this is to give

more room inside the frames and allow a greater sweep to cranks than would be possible or convenient inside the frames. At the left of the machine is located the cylinder that governs the action of the frames, covering the cord needles that rise and fall at each beat of the loom. In addition there is a frame having guides that serve to retain the shuttle in position while it is passing through the shed. In operation the frames carrying the cord needles receive a vertical movement by the action of cams, carrying with them the threads; a pick is thrown, when they immediately descend, the lay comes forward, beats up and on its backward movement the same operation is repeated, except another of the frames may rise, or if all rise, they will have been moved laterally into a different position by the action of cams or similar devices for the purpose. A cam such as is shown, has the figure or concaved and convexed surfaces representing the figure, cut in groove as shown; a pin or pins working in this groove serves to reciprocate the frames and from the figure by moving the needles into a new position at each beat or pick of the loom.

In addition to the loom here shown, we have devices for application to any make of loom, by which two frames may be worked, and produce goods known as trailer patterns, they are now being placed on the market. In conclusion, it has been my desire to make this paper as brief as possible; a subject of this kind requires a practical illustration to obtain a good understanding, and I shall be pleased at any time to furnish all information in my possession to any member interested in fancy weaving, regardless of the class or make of machinery they may have in use.

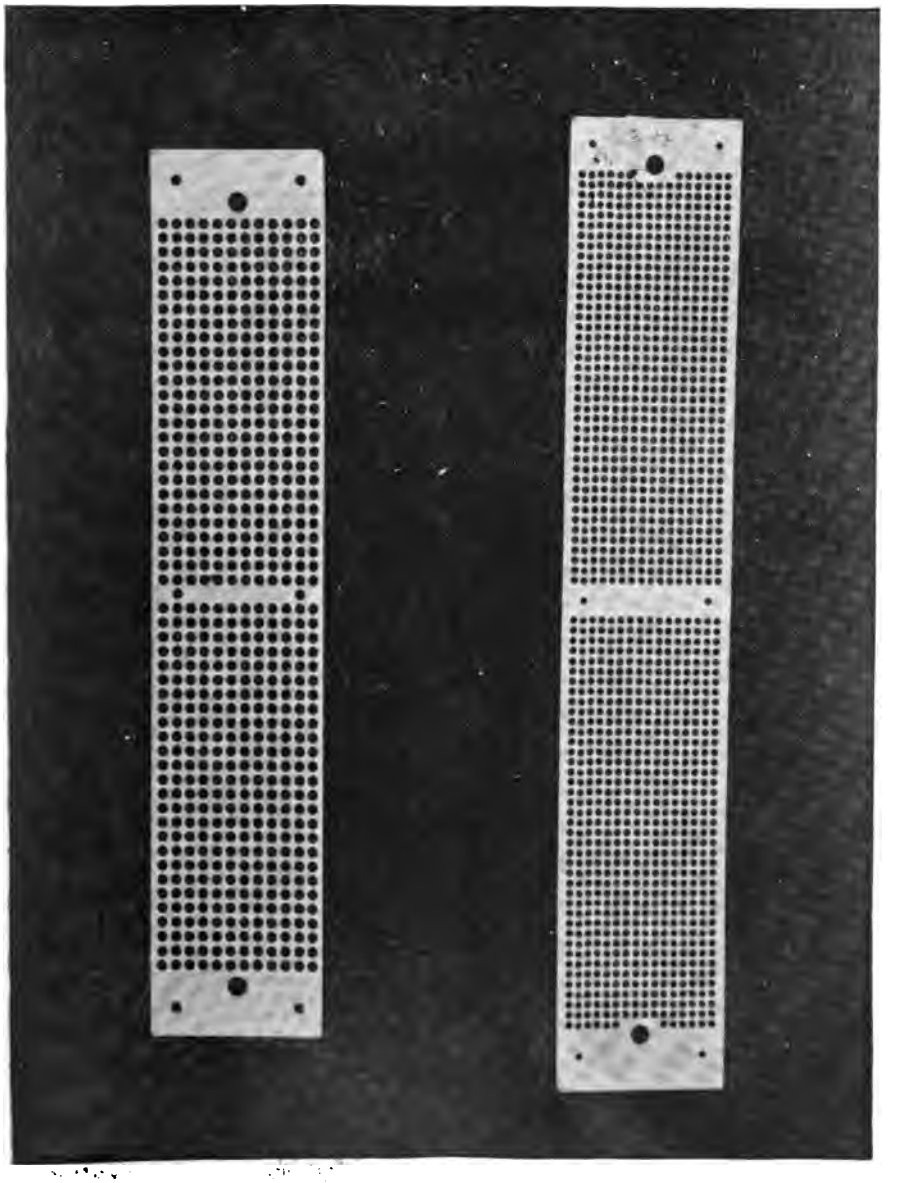


FIG. 11.

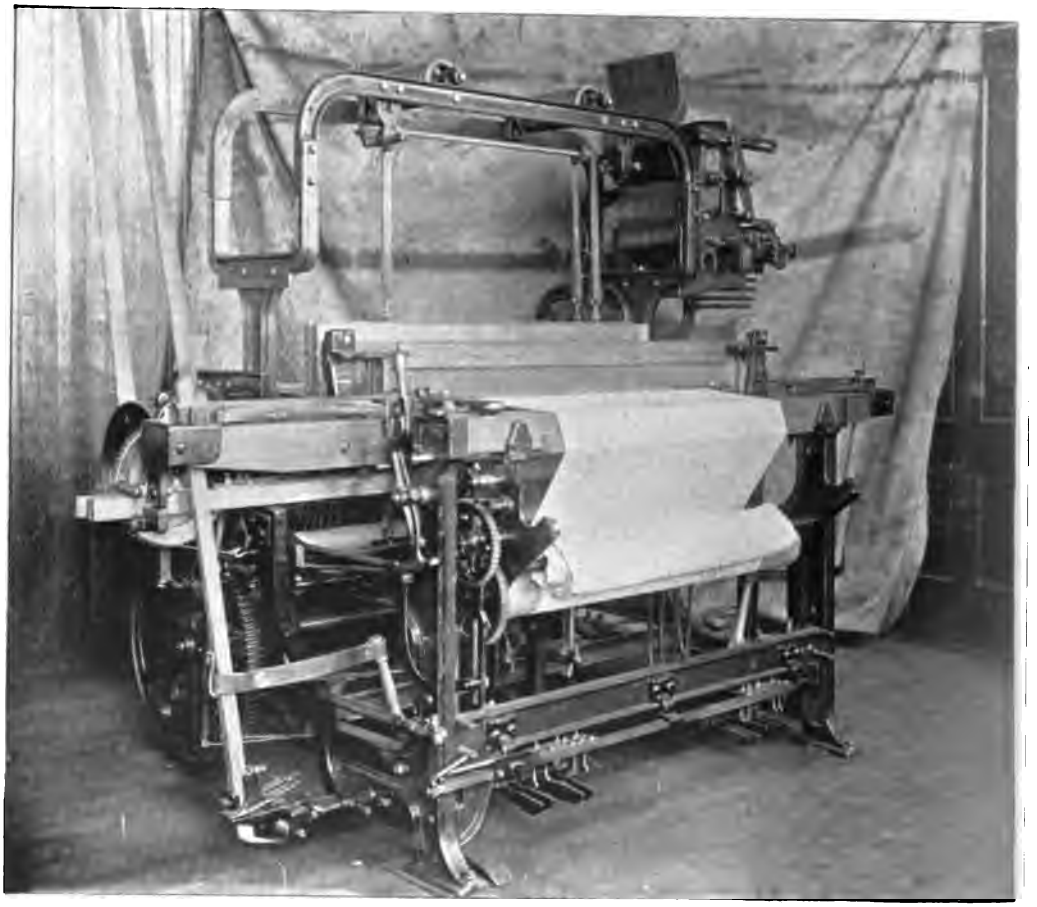
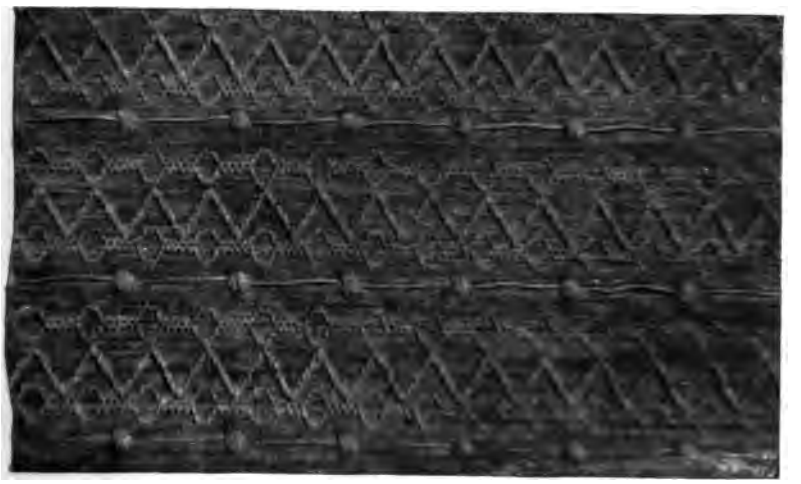


FIG. 12.—LAPPIT LOOM.



LAPPITT GOODS.

The PRESIDENT. The topical questions under this paper are as follows:

4. What is the best motion for weaving Jacquard patterns, single or double action machines?

5. Do weavers run as many looms on Jacquard as on dobbies?

6. Is it profitable to use dobbies for over twenty harnesses, or is it better to use Jacquards?

7. Ought a manufacturer to receive more per pound for goods made on Jacquard looms than on dobby looms, both using same numbers; sley and picks being the same?

9. Is it advisable for manufacturers to run looms on fine numbers at the same speed as on coarse numbers?

Mr. HERBERT L. PRATT. I regret exceedingly to say that I have not had an opportunity to prepare any special data on this question, therefore I am simply prepared to make the broad and general statement that in my opinion the manufacturer ought certainly to receive more per pound for goods woven on Jacquard looms than for goods woven on dobby looms. In the first place it costs more for the Jacquard loom, including the Jacquard head; it costs more to arrange and prepare the design on the loom and furnish the patterns. The Jacquard loom must necessarily be run at a lower rate of speed than the dobby loom. The weaver must be more skilful to operate the Jacquard loom than the dobby loom. The loom fixer must be more skilful and commands a higher rate of wages than the common loom fixer. All these things, combined with several others that might be mentioned, make it necessary, in my opinion, that the manufacturer should receive *more* for goods woven on Jacquard looms than for goods woven on dobby looms.

Mr. JOHN ECCLES. Is it profitable to run dobbies for over 20 harnesses, or is it better to use Jacquard? This topical question seems a practical one, and yet not easy to decide. There are instances, under certain conditions, where it would be better to use the Jacquard when over 20 harnesses are required to weave the pattern.

When there are a large number of Jacquards used in one mill they are run for less cost than where only a small number are used. There is not the same impetus in section hands to excel; less interest in getting off production and doing the work on the most economical basis. I believe Jacquards can be used to produce goods fully as cheap, if not cheaper, than the dobby loom where over 20 harnesses are needed. When woven on dobby the harnesses take up so much space. This requires the loom made with more room between the cam-shafting, crank-shaft and layth to get them in, reducing the angle of the shade and making it very hard on the yarn, particularly the back harnesses, owing to being so far away from the layth. Besides the extra space the loom will take up from breast beam to whip bar. The weaver has more trouble in drawing in the threads; this takes more time to manipulate in the handling of the yarn, the tendency being to bend the wire heddles, getting them all out of shape, adding greater strain and chafing on the yarn, besides the extra weight on the loom making it hard for the weaver, particularly for female help, reaching and straining to put in the ends. A weaver cannot run as many looms. I find it hard to keep help when the work is trying, no matter how good wages they make. Most of the hands prefer the easy part with less pay than hard work and more pay. A manufacturer could run on a certain class of goods almost all the time without changing the sley. Having Jacquard tied up for weaving over 20 ends in pattern, which takes as many harnesses for dobby so there was no possibility in the drawing to reduce this number.

Jacquards would be fully as profitable to run. A good weaver could handle the work to better advantage, run more looms. I do not think a weaver could run four looms with over 20 harnesses. While on Jacquards could run five looms. The dobby would require better and stronger warp. The horse power to run these there would be little difference about the same. But if a manufacturer wants the ends in sley changed from 68 to 80, so it would require the Jacquard retiring up every few warps.

This I do not think any firm could afford, the expense would be too great.

I wish to be thoroughly understood. My proviso is, if the tie-up can remain one thing one count in reed. I am fully aware, with the constant change in style of patterns, this is most impossible. The dobby is more readily changed and at less expense. I shall be pleased to hear from others who have had experience weaving patterns with over 20 harnesses on dobby looms.

Mr. FRANK M. MESSENGER. I should like to ask if you agree with Mr. STAFFORD that the Jacquard cannot be run with so great speed as the dobby?

Mr. JOHN ECCLES. I will say the Jacquard are run daily at as high speed as the dobby loom. It depends upon the kind of dobby, the single or double action.

Mr. WILLIAM EVANS. Upon the question of the best motion for weaving Jacquard patterns, single or double action machines, I should say that it depended somewhat on the character of the goods to be made. On general principles I am in favor of the double action machine for ordinary weaving; but there are goods that you cannot run at the speed that the double action machine is made for, and better effects can be produced by the close shed. Considering that, I am in favor of a rise and fall shed machine, as a machine that can be run at a pretty good speed and meet all the conditions that are usually required in Jacquard weaving. The gauze weave, for instance, can be run on a rise and fall shed, which is a difficult weave to produce, with a double acting Jacquard as it is at present constructed, the ordinary pattern can be woven on the double acting machine at a higher speed possibly than on a rise and fall machine; but there are goods that can be made better and look better with a close shed than with an open shed, and in my judgment a machine that while it does not reach the highest speed limit meets most of the general conditions required, is the best machine to use. And in regard to the matter of the speed of a

double acting Jacquard, I would say that there are some that have been run as high as 180 picks a minute. The rise and fall shed machines have been run at 160, and 140 is the most common speed for single acting machines.

Mr. Wm. G. McLoon. In the last ten years there have been great improvements made in the Jacquard machine whereby we are able to run it at nearly the same speed as we do the 24 harness dobby, on such patterns as could be woven on 24 harnesses. With the straight tie up on the old Jacquard machine 120 picks per minute was considered a good speed for a 30-inch loom, where now with the cross tie up and the rise and drop shed, we are able to run them at 150 picks per minute, with very good results on ordinary fancy weaves, using colored warps and filling, say a count of 80x80, No. 50 warp and No. 60 filling, 32 inches wide.

To compare the Jacquard machine with the dobby for over 20 harness weaves, let us take a weave room of 700 36-inch looms, 350 of them to have dobbies and 350 to have Jacquards, and make cloth similar to the design herewith shown that cannot be woven on less than 24 harness, counting the selvage, 50 warp and 60 filling, or any other numbers of yarn that might be convenient to use in similar goods.

The 304 hooks rise and drop Jacquard machine with all the fittings will cost $75 each (when set up ready to run); 350 Jacquards at $75 each will cost $26,350.

The 24 harness dobbies will cost $35 each, with all the fittings set up ready to run; 350 dobbies at $35 each would cost $12,250; $12,250 from $26,250 leaves a balance of $14,000 (in favor of the dobby) on the cost of the machines.

Now let us compare the cost of running them. Fifty Jacquard looms is as many as a section man can run on work of this kind and keep the heads well cleaned and oiled. Fifty looms to a section would require seven section men to run the 350 Jacquards and the average pay for the Jacquard men is about 22 cents per hour, or $12.76 per week of 58 hours. The pay-roll

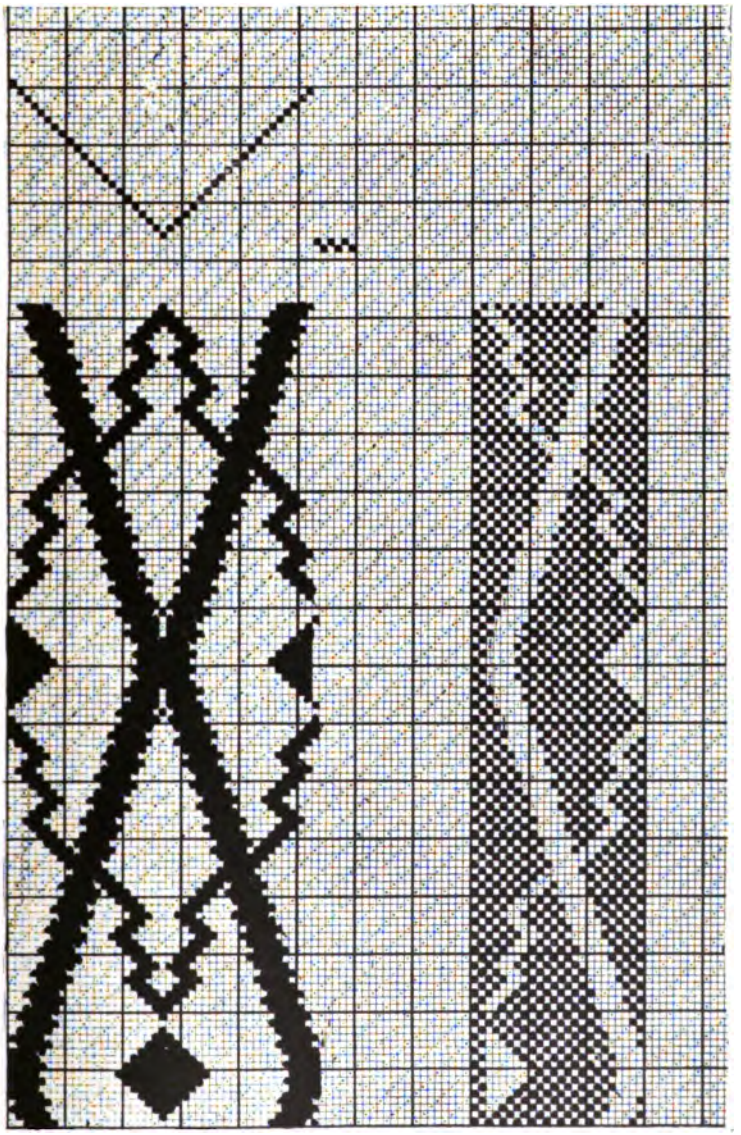


Plate No. 12 8 x 8

DESIGN REDUCED ONE-THIRD. CUT BLACK.

for seven section men at $12.76 each per week would amount to $89.32.

On dobbies, section men would run 70 looms each on work of this kind, and the average pay is $0.207 per hour, or $12 each per week. Five men at $12 each per week would make a weekly pay-roll of $60; $60 from $89.32 (the cost of the seven Jacquard men) leaves a balance again in favor of the dobby of $29.32 per week.

Now let us compare the cost per cut of weaving goods of this kind on the dobby with that of the Jacquard, weavers to run four looms each in both cases, the speed of the Jacquard to be 150 picks per minute, which seems to be as fast as it would be possible to run them on weaves of this kind. We will allow the earnings of the weavers to be $8.50 per week for running four Jacquards, and the same amount for running four dobbies. The dobby would run on double action 170 picks per minute, or 13 per cent. faster than the Jacquard on this weave, and allowing 20 per cent. for stoppage the loom would weave 27.38 yards per day, or 3.29 cuts of fifty yards each per week, and the product of the four looms would be 13.16 cuts per week, the price per cut being $0.653 if the weaver earned $8.50 per week.

The Jacquard would weave, running 150 picks per minute, 24.16 yards per day or 2.89 cuts of 50 yards each per week, and on four looms the weavers would weave 11.56 cuts; and allowing her to make $8.50 per week the price per cut would have to be $0.744 or 14 per cent. more for weaving this kind of goods on the Jacquard than on the dobby.

The next thing to compare is the cost of drawing in on the dobby harness with that of twisting in on the Jacquard in which there is but little difference, for after the first warp has been drawn into the dobby harness, you can twist at the same cost per 1,000 ends on the dobby as you can on the Jacquard.

Cost of Jacquards,	$26,250 00	
Cost of dobbies,	12,250 00	
Difference,		$14,000 00

Cost per week for Jacquard, section men,	$89 32	
Cost per week for dobby, section men,	60 00	
Difference,		$29 32
Cuts woven per week on Jacquard,		2.89
Cuts woven per week on dobby,		3.29
Price per cut on Jacquard,	$0 744	
Price per cut on dobbies,	653	
Difference,		$0 091
Looms run by Jacquard men,		50
Looms run by dobby men,		70

TOPICAL QUESTION.

9. Is it advisable for manufacturers to run looms on fine numbers at the same speed as on coarse numbers?

Mr. CHARLES C. DIMAN. The numbers of yarns as regards speed of looms was not the main factor. It has been my experience that sley and pick was more so. For instance, you might have to construct a piece of goods with a great number of picks, say 150 per inch, to weigh very heavy, and which required coarse numbers. This could not be run at a high rate of speed, not for the reason that the yarn would not stand the operation, but for the reason of the great number of picks that would have to be beaten into a small space. It would be a severe strain on the loom, consequently we should have to decrease the speed. Now if we should make a piece of goods with the same sley and pick, but to weigh lighter, we should have more space for the yarn to work in the reed, and the loom would not be put to so severe a strain in beating in the filling for the same picks, and consequently we could run the loom at a higher rate of speed. To condense the whole subject would say my experience teaches me this very simple rule which is a very easy one to follow: run your looms at a speed, whether they are fine numbers or coarse, that will give the best results, there being no standard other than this from which you can compute.

The PRESIDENT. Is there anything further to be said on this subject? If not, we will pass to the next paper, "Weave Shed Construction." This subject has been receiving much attention of late, and Mr. JAMES R. MACCOLL, of the Lorraine Manufacturing Company has prepared a paper. I take pleasure in introducing Mr. MACCOLL.

WEAVE SHED CONSTRUCTION.

MR. JAMES R. MACCOLL, Pawtucket, R. I.

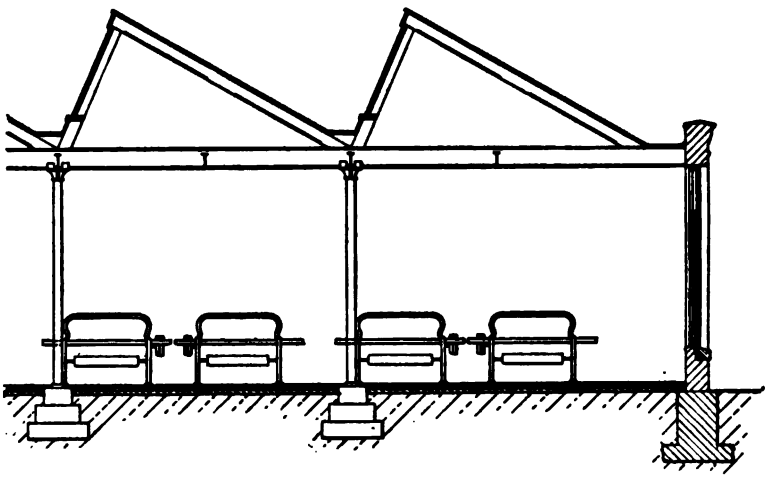
The original subject which I was asked to present to you was "Weave Sheds." In the printed programme it has been evolved into "Weave Shed Construction". It is not my intention to enter into any minute details of construction. This belongs to the mill engineer, or to some manufacturer who has made more of a special study of it than I have. I propose simply to bring to your notice a few different types of weave sheds and mention some of the good and bad points connected with each.

This is an opportune time for our Association to discuss this theme. Mill men are disposed to investigate the merits of weave sheds, and not a few are at present being built. The reason is not far to seek. Gigantic strides have been made in textile manufacturing in this country during the last ten years. Gradually imported fabrics are being supplanted by domestic, and a higher standard of production is demanded. No country in the world requires so much variety, or experiences so sudden and sweeping changes of fashion. When manufacturers tackle fancy goods, they find weaving an important item in the cost, and, in order to secure the best help, and produce goods economically and perfectly, improved weave room conditions are often a necessity.

The primary idea of a weave shed is, I suppose, a one-story

building, with light introduced into the centre from above. In travelling through the manufacturing districts of Europe, one cannot fail to remark how frequently the shed construction has been adopted, not only for weaving, but for other textile processes. There are four manifest reasons: light, moisture, solidity of foundation, and facility in transportation. For ordinary white work, ample light can be obtained from side windows, but if the product is of fine quality, or colored, or has complicated drafts, and especially when Jacquards are employed, the very best light is needed, and this, in a building of reasonable width, must be got, either wholly or partly, from above.

Mr. C. R. MAKEPEACE of Providence has kindly prepared for me, illustrations of three constructions of weave sheds, marked A, B, and C. Design A shows a longitudinal section of the saw-



DESIGN A.

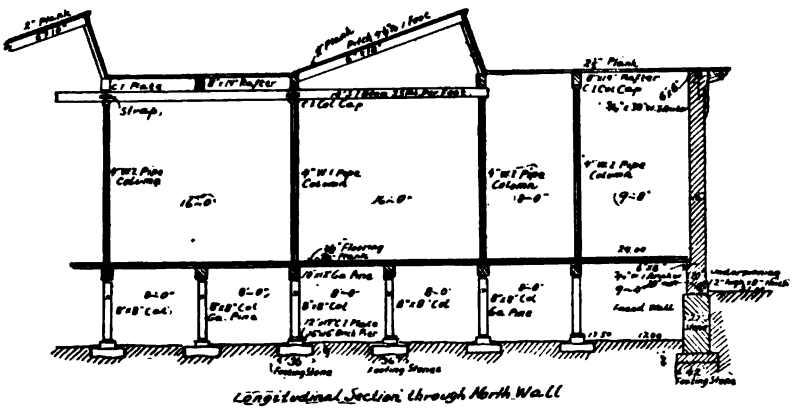
tooth roof. So universally is this adopted in Europe, that its merits as compared with any other construction would be hardly a debatable subject with a foreign manufacturer. It may interest some of you to glance over a volume received a few days ago, entitled "Britain's Greatest Manufacturers," published and distributed by Messrs. Thomas Cook & Son, tourist agents, New

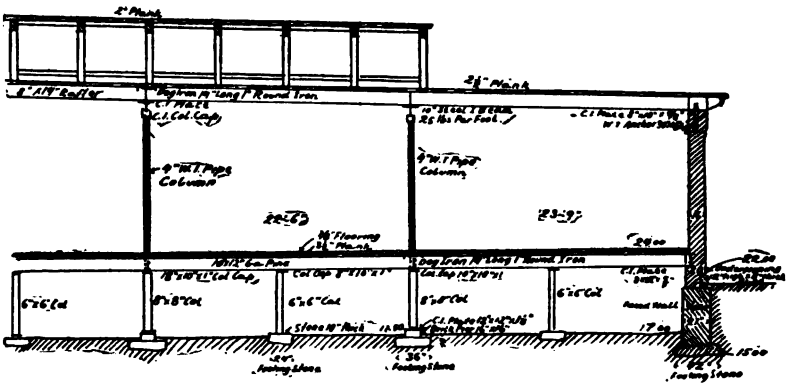
York, and note the frequency of the saw-tooth roof. Clear north light equally distributed to every loom is its distinguishing characteristic. We all know how difficult it is to examine cloth if the light comes from various quarters, and for the determination of fine points we instinctively seek a north window. With a pure north light a weaver can more easily detect faults, such as ends out, wrong draws, shaded goods, etc. It is also worthy of note that a building of this kind is comparatively cool in summer, because the sun never shines into it, and yet in the winter it is protected to a large extent from the direct force of north and east winds, which are so injurious to weaving. Then, again, a building of this style can be made of almost any width or length, and can closely adjoin other buildings, because no light is required except from above. The most modern buildings are constructed with cast or wrought iron columns and steel beams. I presume from an insurance standpoint, cast iron pillars and heavy timbers would be advocated. In lines from north to south the pillars are about 17 feet apart, or the length of two ordinary 40″ looms with alley. The best method is to place the looms transversely to the windows, thus preventing shadows on the warp and cloth. From east to west the bays are about 23 feet, which accommodates four rows of looms with front and back alleys. The columns are hollow, and serve to support the roof, and, frequently also to drain the gutters between the ridges. The main beams run from north to south, and the cross beams are about 8 feet 6 inches apart if shafting is overhead, or 17 feet if shafting is in basement. The rafters are 6 to 8 feet apart, and the roof is 2 to 2½″ plank, covered with tin or asphalt. Corrugated iron tile and slate roofs are frequently used abroad. There are, of course, many other arrangements of columns and beams besides those outlined above.

The saw tooth roof is generally thought not to be adapted to our New England climate, owing to the large quantities of snow and ice which might accumulate between the ridges. I understand that one mill in New Bedford has lately decided upon the

saw-tooth, after a careful investigation of the results obtained where it has been in use. Thorough attention to the details of construction, especially with regard to the gutters and flashing under the windows, will do much to prevent trouble from leaking.

GROSVENOR DALE CO'S. NEW BUILDING.



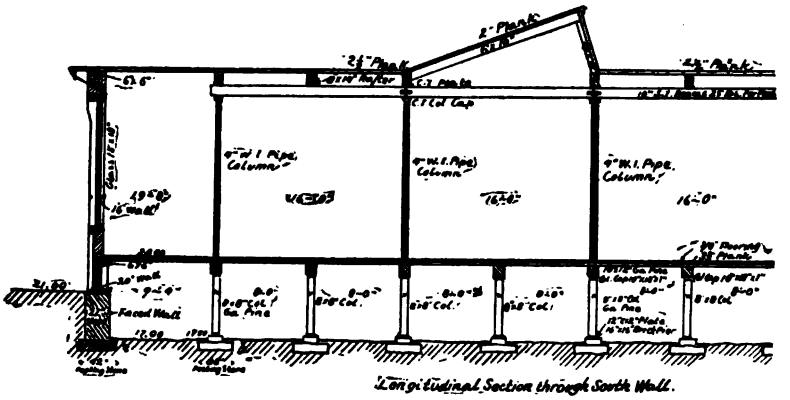


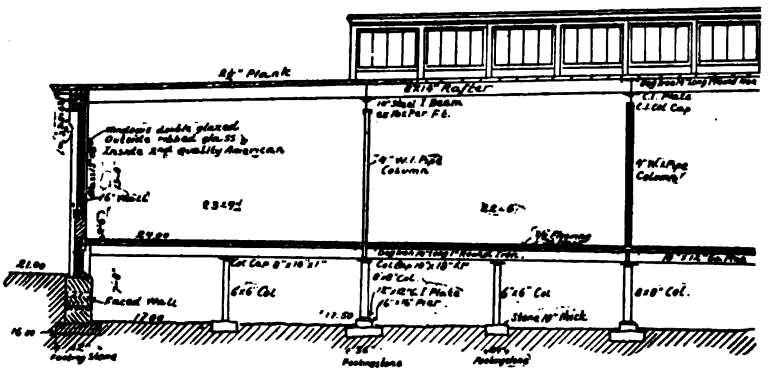
CROSS SECTION.

Mr. F. P. SHELDON of Providence is at present erecting some weave sheds with modified saw-tooth roofs. He has kindly supplied a blue print showing longitudinal and cross sections of the Grosvenor Dale Co.'s new building. This structure is about

184 feet wide, and is framed with wrought iron columns, steel beams running longitudinally, cross timbers, plank roof with asphalt on sloped part and tar and gravel on flat portion. The main features are the alternating bays of saw-tooth and flat roof,

GROSVENOR DALE CO.'S NEW BUILDING.





CROSS SECTION.

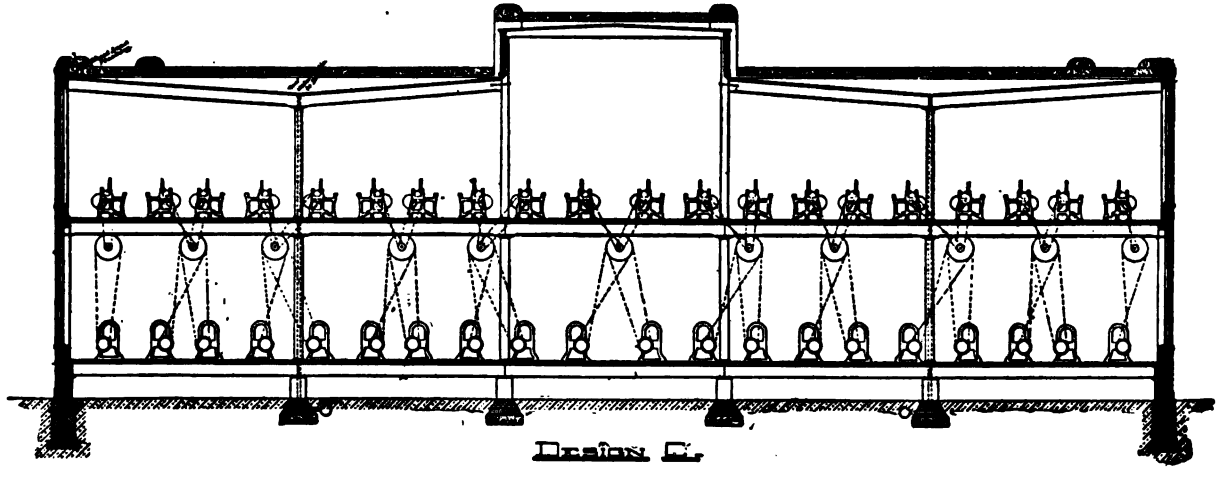
and the pitch of 3/8″ to the foot on the whole roof from the centre to the outside walls of the building. It should also be noted that the saw-tooth extends only to a point about 23 feet from the outside wall. This construction reduces the danger

from snow and leaks, and prevents the necessity of draining through the columns. It must not, however, be forgotten that it only gives half the amount of light that the ordinary saw-tooth does, and I am afraid that for some kinds of weaving there may not be enough light on part of the looms. The plan of combining saw-tooth and flat roof seems a good one. If by some change in construction the advantages can be retained without sacrificing light, possibly an ideal roof for our climate might be found.

Design B shows a cross section of a monitor roof applied to a building 88 feet wide. The outside spans are 24 feet each and the monitor 40 feet wide. This gives an excellent distribution of light, as no loom is more than 24 feet from a window. There are fourteen rows of looms, as shown on drawing. The monitor is trussed and the bays are 8 feet wide. There is a wide alley at each side of monitor. Every loom is well lighted, but curtains have to be used and the transom and monitor windows painted.

Design C is a cross section of the new Whitman Mill planned by Mr. C. R. MAKEPEACE, and shows a monitor roof construction in a mill 125 feet wide. There are five spans of 25 feet each and twenty rows of looms. The main roof at each side pitches to the centre, and is drained by pipes carried down at side of posts. By framing the roof in this way, the advantages claimed are longer windows, stiffer roof, and a more uniform height to the room than if the roof were graded from the monitor to the outside wall. The lines of the roof are so designed with relation to the windows that the light from the monitor meets the light from the side windows and there is a good distribution to every loom. It is not within the scope of this paper to discuss the advantages or disadvantages of locating looms above carding or spinning, and driving them from below. This construction can be used of course equally as well for a shed with or without basement, and seems to me an excellent one of the monitor type for a mill about 125 feet wide.

PLAN



Design C.

Another style of roof is the hipped skylight, but except in special circumstances where a large amount of direct downward light is required, I do not think much can be said in its favor.

Coming now to the basement question, the benefits of placing looms on the ground, over concrete and plank, are solidity of foundation and consequent freedom from vibration. It is also claimed that there is more natural moisture on the ground floor than on any other. These are important considerations when running high speed looms on fine or fancy work. There is, however, a great deal to be said in favor of a basement as shown in Design B, and also on the smaller cross sections. With the shafting all below there is less frictional electricity generated, and the moist cellar air is continually being carried into the weave room through the belt holes. Vibration can be reduced to a minimum by framing the floor with heavy beams 8 feet apart, supported by ample posts and using plank and top flooring of sufficient thickness. With beams 10 x 14 or 12 x 16, plank 3″ to 3½″, and 1⅛″ top flooring, the looms must run very steadily. A higher standard of cleanliness can also be maintained. A new weave room with shafting over head will be dirtier after running three months than a similar room, with a basement and shafting below, would be after running three years. The percentage of dirty goods would also be larger in the former. This may be unimportant in many instances, but sometimes it pays to produce clean goods and to educate help to a high standard of neatness. A basement can also be utilized for storage of filling or warps, and affords ample space for systematic arrangement of loom parts, required at intervals, on account of changes of work, or repairs.

It should not be lost sight of that driving from below generally necessitates a belt at least 3 feet shorter between centres. Some manufacturers might prefer overhead shafting for this reason alone.

Regularity of speed in a weave room is important. Too slow speed means loss of production; too high speed, work that runs badly. Power should therefore be conveyed as directly as pos-

sible from the engine, and the shafting and belts should be adequate, so that in various weather conditions, and with a large number of looms picking at one time, no difficulty will arise, and a uniform speed will be obtained.

There are many interesting questions in connection with windows and glass. Some modern mills have windows with two movable sashes, but most have a single fixed sash. The latter tends to better discipline by preventing help from throwing waste or refuse into the yard, and shouting to passers-by. The transom window opening horizontally affords ample ventilation, in conjunction with other means. Windows should be carried up close to the ceiling, so as to throw light as far as possible into the room. I have not found any objections to double glazing as a means of saving heat and moisture and preventing condensation in cold weather. The saw-tooth windows in Grosvenor Dale Mill I notice are to be double glazed, no doubt for these purposes.

The tests recently published by Mr. ATKINSON, of ribbed and clear glass, are worthy of note. His contention is that the former gives more and better light, and less heat. If this is confirmed in actual mill experience, ribbed glass will doubtless be generally adopted. From a test recently made in a new building with the No. 4 ribbed glass, I do not think that it does sufficiently break the strong rays of the sun to enable shades or white paint to be dispensed with.

Another point to be determined is whether ribbed glass would give more light than clear glass in a saw-tooth building with northern exposure.

Moisture and ventilation are important matters in a weave room. Mr. B. A. DOBSON'S pamphlet on * "Humidity in Cotton Mills" should be read by every manufacturer. Most of us need more accurate hygrometers in our mills, and more careful reports as to the moisture in different parts of the same room, and at various temperatures, so that the best conditions

* Contained in Transactions, Vol. 57, page 185, Sept., 1894.

for good work may be determined. There are several systems of moistening in use. Steam jets or pots which were so generally used until recent years are now discarded. Moistening by natural evaporation from troughs of flowing water, mechanical vaporizers like the drosophore or the vortex humidifier, and the blower system, are now in vogue. Mr. DOBSON points out that with mechanical vaporizers the moisture is not thoroughly blended with the air, and at various distances from the machine very different hygrometric conditions exist. I have found this statement confirmed by several tests. Satisfactory results are being obtained by the blower system in many mills, and personally I believe in it for high studded weave rooms. Ample and evenly distributed moisture can be put into a large room in a few minutes, and it seems practicable to blow 200 feet from a central stand-pipe in a room 88 feet wide, and heat and moisten with uniformity. In summer the atmosphere is delightful to work in, and it is a relief to come from outside into a room so ventilated. In the March number of the "Manchester Textile Manufacturer" there is a description of an elaborate system of moistening, that is being introduced into German weave rooms. It is the blower system with the air forced through chambers containing a latticed brick wall, on which water is trickling down. In this country we seem to get at the same result more simply by a jet of steam or water in our blower pipe.

For heating, the blower system has not been considered economical where brick flues have been built in the basement or outside wall. There is too much wasted radiation. But if the piping is in the room to be heated, and in winter the air to supply the fan is drawn from the room, excellent results are obtained as compared with steam pipes.

In laying out a weave room, if various kinds of looms and classes of work are required, there is ample scope for careful consideration as to the most economical arrangement. Each weaver must have enough to do, and not too much. If the work changes, the looms should be planned so that more or

fewer looms can be run by a weaver, without necessitating rearrangement. Back alleys should be wide enough for free passage of beams, and when fancy work is contemplated, to accommodate extra beams on each loom. Front alleys should be wide enough to make it unnecessary for an overseer to caliper a weaver before hiring him. Cloth room, filling room, and drawing-in room should be conveniently located, so that weavers and fixers have not too far to travel.

I have not entered into the question of cost of various constructions. The *best* is the cheapest, in weave sheds, if anywhere. In deciding about a weave shed, there are in every case many special conditions to be thought of, such as location, cost, kind of product, and style of looms. A weave room that would be just right for one manufacturer might be entirely wrong for another.

Permit me to say in conclusion, that I am not an expert on this subject, and have somewhat unwillingly accepted the task of presenting it to you. In these dull Democratic times, I am more interested in the science of running weave sheds profitably than in knowing how to construct them. I trust, however, that my remarks may at least provoke an edifying discussion among the members present.

The PRESIDENT. We will pass, gentlemen, to what you might call the *piece de resistance* of this meeting, which is the Northrop loom. The Board of Government believes it is not possible to bring forward a subject of greater interest to the members than the Northrop loom, and I am very glad to ask Mr. FRANK M. MESSENGER, of North Grosvenor Dale to open the subject.

Mr. FRANK M. MESSENGER. I appreciate the remarks of our President in regard to the importance of the subject, but had he invited me to have written a paper on what I do not know about the Northop loom I might have been able to present one of greater length; but as brevity is the soul of wit, perhaps we will enjoy the occasion better after the question is open and the ball set rolling, to talk it over among ourselves in the discussion.

THE NORTHOP LOOM.

MR. FRANK M. MESSENGER, North Grosvenor Dale, Conn.

I think it was Emerson who said, "When a new boy comes into school, or when into an old club a new comer is domesticated, that happens which befalls when a strange ox is driven into a pen or pasture where cattle are kept; there is at once a trial of strength between the best pair of horns and the new comer, and it is settled thenceforth which is the leader."

It might be said with equal force, that when a new machine or a new method of operation, so radical as the Northrop loom, is introduced, there is a like trial of strength; in fact, an innovation so far reaching in its effect upon our cotton industry as this is designed to be, must necessarily not only invite criticism, but it must meet with opposition; it must earn its way if it "gets there," and nothing short of actual merit is a price sufficiently large. To say that the new comer has already met and vanquished all obstacles would be to overstate the matter, and we think would outdo the claims of its owners, but it is certainly *in* the race and has already become a lively competitor; we speak only of what the loom has thus far been designed or intended to do.

We have 48 of these looms in one mill all operated by three weavers; they are producing about 96 per cent. of continuous

running; it is our opinion that each of these weavers could easily attend 20 of these looms on this class of goods — it is a light weave — 52 x 52-38″, 8 yards per pound, and we pay 13 cents per cut against 23¼ cents per cut for same goods on the common plain loom; the weavers make more money with less expenditure of labor than on the same class of goods on the common loom.

In another mill we had 287 plain Whitin looms weaving heavy sheeting 80 x 92-40″, 3.40 yard goods; these looms were all taken out and replaced with Northrop looms, continuing on the same kind of goods, and at the same speed; on a ten-weeks' run ending March 21, 1896, we have woven, as compared with a corresponding period in 1895, when the common loom was used, 14,970.5 yards more cloth, at a reduction in cost of labor and supplies, of $449.31. The items of labor cost taken are only such as are affected directly by the change in looms, that is we have taken the cost of drawing in, day and job labor in the weaving. It was our intention when our President invited me to prepare a paper, to have weighed the power used by the two kinds of looms, but limited time has prevented. We have, however, for some years made daily readings forenoon and afternoon of the wheel gates, head acting on wheels, have indicated the engines, and from the above data computed the power used in driving the mills, keeping a record of same; from such records we find that the power for the whole mill during the ten weeks in 1895, while the old loom was in use, was 262.4, and 264.7 for the whole mill during the 1896 period while the Northrop loom was in use, thus showing that with a larger product the power required to drive the whole mill was not increased to any appreciable extent by the introduction of the Northrop loom.

We have learned some things about the handling and operation of these looms, we believe that we have still more *to* learn. Owing to the large number of looms which a weaver is enabled to attend, we believe that some improvements are called for

in the preparation of the yarns, both warp and filling, or at least such improvements offer better returns on this loom than on the common loom. We believe that there are greater things in it than have yet been brought out by the operators — we mean the loom as it stands to-day, and we have no doubt we could show a very much improved report a year hence without any particular improvement in the loom itself; the fact is we are paying too much; our weavers are making from 20 to 25 per cent. more pay on these looms than they are on the common loom, and doing it with less labor, but prejudice must be lived down in the operative as well as in the manufacturer, and we have not felt it wise to cut too short corners on the start. We are changing help but very little indeed as compared with the other mills where we have the common loom, which speaks well for the loom and confirms our statement regarding the labor expended for the wages earned.

Topical Questions.

3. Will the new Draper loom require more repairs than an ordinary loom, both being run at the same speed? If so, how much will these repairs add to the cost of cloth made on the Draper loom?

18. Can the Northrop loom be run profitably at the same speed on print cloths as the Whitin loom?

The PRESIDENT. There is one mill in New England which is entirely filled with Northop looms, and its agent, Mr. JOHN H. HINES, has kindly consented to tell us of his experience with it. (Applause.) Mr. HINES was here earlier in the afternoon, but has been called out to a directors' meeting. He has left a statement, however, which I will ask the Secretary to read.

The SECRETARY (reading the statement of Mr. JOHN H. HINES). Perhaps it will interest you to know something about the Queen City Cotton Co. We have in operation 792 Northrop

looms, all of which are proving very satisfactory in every respect. We produce a little over a cut per loom each day (the cuts being the same length as those at Fall River) and I have every reason to believe that the cloth we manufacture is of a superior quality.

The total cost of labor for our weaving room will average $1\frac{8}{10}$ cents per pound. We are speeded 184 picks per minute, and manufacture 28-inch 64x64. I do not think at this time that I could give a fair average of the cost of supplies and repairs, as we have made quite a number of changes which, although included under the head of repairs, are of a nature of permanent improvements; later on I can give a fairer estimate of this item. The slashing costs 9½ cents per 100 pounds of yarn; the drawing-in, 15 cents per 100 pounds of yarn. Our weavers are running 16, 20 and 24 looms respectively. The 24 loom weavers average 158 cuts per week at 9 cents per cut, the average warp thread breaks are 10 per loom per day. Our fixers are now attending 80 looms each, but with the change under way I expect that they will be able to care for 100 or more each with the same good results they are now attaining,—weaving over a cut per loom per day with an average of a little less than one per cent of seconds, as is shown from the record of the last three months.

When you consider that this is a new mill with a new loom and consider the great many difficulties we have had to overcome, such as inexperienced labor, I think the result very gratifying and the outlook very encouraging. The looms are run during the noon hour without attendance, and we find 70 per cent of them running at bell time. (Applause.)

The PRESIDENT. Mr. H. D. WHEAT, the Treasurer and Agent of the Gaffney Manufg. Co., and of the Tucapau Mills of South Carolina, is unable to be present, but has written a most interesting letter and given full and complete information of the looms at the Tucapau Mills, and I will ask Mr. WALTER E. PARKER to read the letter.

Mr. WALTER E. PARKER read the following statement from Mr. H. D. WHEAT:—

Agreeably to promise made you a few days ago, I beg to give you herewith my experience with the Northrop Draper loom at Tucapau Mills, of which I am treasurer and general manager.

We started 320 of these looms about six months ago on regular 60 x 64, 27-inch print cloths, made from 28s warp and 36s filling. From the first start the looms have far exceeded our expectations; we found our help could, after three or four days, run these looms as well as the ordinary ones, in fact, they preferred to run them. Our plan in starting was to take six-loom weavers from the ordinary loom and give four of the Northrop looms the first day or two, and then increase the number until the overseer decided that they had as many as they could attend to and keep them running; in this way we could determine just what the weaver could do. We had, as every other mill has, some good, some fairly good, and some poor weavers. We found that the fairly good six-loom weaver on the ordinary loom could run twelve to thirteen Northrop looms; the good six-loom weaver thirteen to sixteen looms; while the poor ones could run from ten to twelve. Our average of the whole mill is nearly thirteen looms to the weaver.

We run these looms 183 picks per minute, and for January, counting all looms as run, we got a product of $54\frac{54}{100}$ yards per loom per day of eleven hours, or $97\frac{55}{100}$ per cent. of the actual running time. For February we did not do so well, owing partly to our being a little short of warps; however, we counted all looms as run and got a product of $53\frac{93}{100}$ yards per loom, or $96\frac{45}{100}$ per cent. When I say $97\frac{55}{100}$ per cent. and $96\frac{45}{100}$ per cent. of the actual running time, I mean it in every sense of the word, no over-time morning, noon or evening. For the month of March it was $97\frac{83}{100}$ per cent.

The weavers run their looms without any help whatever except the oiling; this we have a boy to do. The cleaning is done by the weavers, mostly before and after bell time and

when warps are changed. No children are used for filling batteries, etc. As before stated the help prefer to run these looms to the ordinary ones, and we find that it does not require as much skill to run the Northrop loom as it does the ordinary one, from the fact that the Northrop very seldom makes a bad break-out, as the loom stops before warp threads become entangled in the harness, thus saving pick-outs, etc.

In the South most of the mills try and regulate the price of weaving so a good six-loom weaver can make from 90 cents to $1.00 a day. At Tucapau we pay 7 cents per cut of 50 yards, and the weavers make from 75 cents to $1.20 per day, or an average of 98 cents for the whole room. This is a saving in weaving over the ordinary loom running on the same kind of goods of three-fourths of a cent per pound, or 33 per cent. saved in weaving with an increased product of about 5 per cent.

The quality of cloth is better than from the ordinary loom; very few seconds are made on this loom caused by the loom. In reference to loom fixers, we had no trouble whatever in taking fixers from the Whitin and other make of looms and in a very short time have them running successfully the Northrop loom. Our looms are placed in two rooms, 160 each; we have four fixers running 80 looms each. If the looms were so arranged that we could put them on 100 looms each we would do so; in fact, the men tell us that they have less fixing to do on the Northrop loom than on the ordinary one; the Northrop running with one shuttle calls for less adjustment of picking straps, etc.

As to repairs for these looms, anyone would naturally suppose that they would require more repairs than for other plain looms, but so far our experience has been the reverse. Since the looms have all been running, from September 15th to March 15th, six months, we have bought from the Northrop Loom Company $273.57 worth of repairs, not including shuttles; take one-half of our total repair shop work and count it as work done for looms and add the above $273.57, and we have a total of

$527.07 for 320 looms for six months, or about one cent per loom per day. The cost of shuttles for the same six months was $426, but, as you know, in starting new looms more shuttles are broken than after the loom has been run a while; then, too, the price of shuttles during the six months was $1 a piece, while now they cost only one-half that amount, or 50 cents a piece. Take the saving in first cost and add to it the fact that the swells on shuttle box have been improved by lining the swell with leather, which we find a great shuttle saver, and I think the item of shuttles is reduced to about the same cost as for the ordinary loom.

All in all, we are very much pleased with the loom and to show our faith in them we are now starting 1,040 more of them in our Gaffney Mill and expect soon to place an order for equiping our third new mill which we are now building.

The PRESIDENT. This would complete the direct evidence in regard to the Northrop loom, but we are unexpectedly fortunate in having present with us Gen. W. F. DRAPER, and I know that the members will be glad to hear from him either on the Northrop loom or on the chances of Republican victory next November. (Applause.)

Gen. W. F. DRAPER. Mr. Chairman and gentlemen, I don't think I will bore you with a political speech, as politics seem to be substantially all one way in this meeting, and I trust that they will be in the country as a whole next November. (Applause.) In regard to the Northrop loom, I have listened to these papers which are new to me, with a great deal of interest. I have not prepared myself with any statistics, thinking that it would be more interesting and perhaps more convincing to you to hear from gentlemen who have had these looms in large numbers in actual operation than to hear from the builder of the

looms as to what they would do. I wish to say, however, from my standpoint, from my knowledge in general, and experience with this loom in particular, that the Northrop loom has come to stay, as have and will all inventions and improvements that effect real revolutions in the art to which they apply. Minor improvements sometimes fail of adoption, because they are not of sufficient importance or value of themselves to overcome the conservatism of manufacturers or to enlist the enthusiastic and pushing support of builders; but when an invention or an improvement shows to the user a very large dividend in dollars and cents, and when that dividend can be shown to be real and to exist in spite of all deductions that can possibly be made, if that improvement is controlled and pushed by men with energy and capital, it is pretty sure to go into general use.

Now, taking the Northrop loom, we start with this fact: the cost of weaving in this country, perhaps in all countries, is half the cost of manufacture. I refer to the labor cost; taking our looms as a whole, the labor cost of weaving is half, or perhaps a little more than half, the cost of weaving cotton cloth. Now this cost of weaving, so far as the labor of the weaver is concerned, can be divided by two by the use of the Northrop loom. Let us see what an enormous amount this is. I suppose that weavers on plain goods in this country average to receive as wages perhaps $60 a loom a year; on print cloths, it might be a trifle less. If a print cloth weaver weaves a cut a day, receiving 18 cents, it would be about $55 a loom a year, and of course when running other looms where the weaver tends a less number, the amount would be increased. Calling it $60 a year, if half the weavers can be saved, that half is $30 a year; and unless there is something very extensive to off-set that, that $30 per year per loom is enough to pay dividends on the capital stock of the most of your corporations. Now the real questions in regard to this are: first, Does this actual saving in labor cost exist? Second, Is the fabric produced of equal quality or of better quality? Third, Are there any objections or any extra items of cost that tend to off-set this great saving that I have referred to?

In regard to the first point, we have not an enormous number of looms running, some five or six thousand, but at the Queen City Mill, from which a letter was just read from Mr. HINES, they have been running a year 792 looms. They are weaving 64 square print cloths, and I am informed that there are 64 picks of filling as well as of warp in each inch. In Fall River, I understand that the payment per cut of 46½ or 47 yards for weaving these cloths is 18 cents. In the Queen City Mill the payment per cut is 9 cents, and the weavers in the Queen City Mill make more money than they do in Fall River on the average. Taking the weaving room at the Queen City Mill the average number of looms per weaver is substantially 16, but there are, if I remember correctly, 15 weavers in the mill running 20 looms each, and one or two running 24 looms each, and, as is found in other mills, those running the largest number of looms get the largest production per loom. The 20-loom weavers have averaged for the last two months, as I am informed, over 120 cuts per week, and at 120 cuts the amount they would receive for weaving print cloths would be $10.80.

On the other side, in labor cost the section hands at the Queen City Mills are more in number. We had the feeling in commencing with the loom that the mechanism was somewhat complicated; that it would require more skill, and that it was wise to be on the safe side; and the Queen City Mill has started with 80 looms to a section hand. Our experience there, however, leads Mr. HINES, who is running the mill, to believe that the number of section hands can be reduced, and he will soon undoubtedly experiment in that direction. From my own standpoint I cannot see why this should not be done, as the loom has but one shuttle and there is less trouble in setting the pick; and the filling changer itself very seldom gets out of order from the fact that it does not operate quickly — it operates once in seven or eight minutes, while the rest of the loom operates 200 times a minute, and this particular item not only prevents its getting out

of order but prevents its wearing out. Another item where there has been a somewhat larger cost of labor on some of the looms that we have put out, has been in "drawing in." We have sold two kinds of looms — one using the ordinary twine harness, with a detector behind the harness to stop the loom when a warp thread breaks, and another where the harness itself is a detector and made from flat steel wire. Where the steel wire harness is used the cost of drawing-in should be no more and probably will be no more than with the ordinary harness; but where the twine harness may be used there is an extra piece to draw the thread through, and the cost of drawing-in must necessarily be more. As far as we have gone we are inclined at the present time to recommend the use of the steel harness.

Now as to the quality of the fabric produced, it seems to me that there can be no doubt, because of the facts that the cloths from these looms have been sold without the slightest difficulty, and that from some parties we have received very high recommendations, that the cloth must be better from these looms. There is no reason why it should not be equally good filling-wise, and there must be and are very many less warp threads lacking in the cloth. With this loom, when a warp thread breaks the loom stops. There is no warp stop motion in the ordinary loom. The loom works until the weaver stops it, and leaves one or possibly more threads missing for some distance. Another thing, these threads that are out snarl and cause what are termed "pick outs," and there must for that reason be many more of these faults in ordinary cloth than in cloth woven from the Northrop loom. So I think it is fair to conclude that while the cloth woven costs less to weave, it will be better in quality than the cloth woven on the ordinary loom. I will say in this connection that we are going still farther in the matter of improving the cloth and that we have not yet reached the point of putting out looms for that purpose. And by throwing out the filling before it is exhausted, if we succeed in doing it, we shall make absolutely perfect cloth such as has not been woven by

any power loom. The warp threads will all be there, and the filling threads will all be there, and the cloth will be the same as if it were all woven by one shuttle, every warp thread being in place. This is something we have not yet accomplished, but when we do, we feel certain that the makers of extra nice fabrics will necessarily use these looms, because they will be the best machines to make them upon.

Now coming to the matter of repairs, which is another question which has been raised, I have no doubt, although Mr. WHEAT of the Tucapau Mills seems to think differently, that there will be somewhat more repairing on these looms than there will be on the ordinary looms, from the fact that there is more machinery to get out of order. In addition to the parts of the ordinary loom there is the filling changer and the warp stop. The filling changer itself operates very seldom, and there should be very little wear in it; while the warp stop motion is liable to wear and breakage like other parts of the loom. I understand a fair estimate for repairs of an ordinary loom is somewhere about $3 a year, and I should say for an estimate that with the looms properly fitted and in good condition, an addition of 10 per cent. ought to be as much as would be required to keep these looms in order. In saying this, I will except the shuttle. The shuttle of the Northrop loom is somewhat more complicated and when it needs repairing it costs more money to replace, but I will say further that probably this will be very much more than offset by the harness. We find that the steel harness is the desirable one to use as a standard so far as we have yet gone; there is no apparent wear, and we are in hopes that it will prove to be as lasting as the rest of the loom. If our hopes should arrive at fruition there is no question but that the saving in wear of the harness will more than offset the *extra* wear and tear of the rest of the loom and the wear of the shuttles.

There is only one more item to refer to and that is the cost of the loom itself. In regard to that there is only this to be

said, that if it is, as I believe myself and as trial so far has proved it to be, a real advantage and advance in the state of the art, the maker and seller of these looms will be compelled to sell them at such a price that the purchasers will derive a part of the benefit. That is, no one can sell a machine and retain all the benefit of it himself, and our firm, if you will pardon a little advertising, has always intended to go on the principle of giving the purchaser the lion's share of the benefit. (Applause.)

In regard to the volume of business, it may be interesting to you to know that up to date we have shipped from our shop about 6,000 Northrop looms. We have now under contract, I believe, about 3,500 more — if I am wrong my brother will correct me — and we have also made arrangements with several of the principal builders of looms, including the Mason Machine Works, the Knowles Loom Co., Kilburn, Lincoln & Co., and the Lewiston Machine Co., to build looms of their own make with our appliances attached, for such people as may desire to use them.

I should be very glad to answer any questions that any gentleman wishes to ask me, and if there are no questions to be asked me, I thank you, gentlemen, for your kind reception. (Applause.)

The PRESIDENT. Cross-examination is now in order, and I hope the discussion will be a very free and general one.

Mr. ARTHUR H. LOWE. I should like to ask Gen. DRAPER if to his knowledge there has been any additional cost put upon the yarn, in the way of better cotton or additional cost in spinning, in preparing it for these looms?

Gen. W. F. DRAPER. So far as I know the only thing in that direction has been where the cotton harness has been used, and in that case there has been extra care taken in the making of the sizing. Where the steel harness is in use, there has been no special pains taken with the sizing, but where the cotton harness

is used, the thread goes through an extra piece or detector and special care has been taken. What the extra cost of that may be or may have been, I don't know. It cannot be serious. I suppose it is a good idea to take those extra pains anyhow.

Mr. JAMES WARING. What is the extra cost of the cotton over the steel harness for the loom?

Gen. W. F. DRAPER. The detector has to be furnished extra, but I suppose the cost is about the same in one case as it is in the other; that is, the loom is sold with a steel harness complete, and the loom is sold with the detectors complete; and then the manufacturer applies the cotton harness to suit himself. If we sell the steel harness we sell one set with a loom, and that has so far lasted, and we think it may.

Mr. GEORGE F. WHITTEN. The Amory Company has fifty Northrop looms. I have not any figures with me, but will give them as I remember them. They are weaving 40-inch goods, 68 x 80, 3½ yards to the pound, running 160 picks, producing 95 per cent. of a possible product. We pay on these looms 20 cents a cut, and 36 cents on the Lowell loom. We have one section hand for the 50 looms, and one oiler and four weavers. That is about all I can say in regard to them.

Mr. W. J. KENT. Gen. DRAPER has just told you that when we purchase anything from the firm of George Draper & Sons the purchaser gets the lion's share. I was not aware of that fact before, and if such is the case, my sympathy goes out to the lamb every time.

At the Atlanta meeting the President called upon me to tell what I knew about the Northrop loom; it was very little I did know, but I made a statement which my friend, E. S. DRAPER, afterwards told me I must have had great courage to make. I am happy, however, to be able to get up and tell you today that a part of that statement has been proven by my friend Mr. WHEAT.

In the report of the Atlanta meeting on pages 106 and 107 you will find that I am quoted as saying: "I think my friend

Mr. WHEAT, who, I understand, is putting in a lot of these looms (referring to the Northrop loom) will show you people of the south and some of us at the north, that there can be no more production gotten out of this loom than is now being done at the Queen City Mill." The word "no" in this report should be stricken out for it does not convey the meaning which I intended; it should read, "that there can be more production gotten out of the looms than is now being done at the Queen City Mill." It makes a great difference whether that little word "no" is put in or left out, and I wish all the members of this Association who are now present would scratch that word out when reading the report.

Gen. W. F. DRAPER. There is one element, my son tells me, that I forgot to mention, which is a matter of some importance. That is, beside the number of looms I mentioned as having been sold there are some thousands that are being applied by the Amoskeag Company that were not mentioned; and in reply to Mr. KENT, I wish to say this, that it is not any special benevolence on our part that induces us to deal so leniently with manufacturers, but they are such shrewd and able men that they get the better of us in the bargain.

The PRESIDENT. A most valuable paper on Swiss cotton manufacture has been prepared by Herr TH. OTTO SCHWEITZER of Switzerland, and is in print, and copies will be distributed to the members. As it is quite lengthy and our time is limited, it will be read by title only. It will appear in full in the Transactions, with engravings, plates, etc., and as Herr SCHWEITZER is not a member of the Association, I suggest that a vote of thanks be passed for his able paper.

On motion of Mr. PARKER, a vote of thanks was extended to Herr SCHWEITZER for his interesting paper.

COTTON MANUFACTURING IN SWITZERLAND.

HERR TH. OTTO SCHWEITZER, FRAUENFELD, SWITZERLAND.

COTTON MANUFACTURING IN OLD TIMES.

Switzerland is, as is known, situated about in the centre of the European continent; it is bordered on the east by Austria, on the south by Italy, on the west by France, and on the north by Germany. The country is mostly mountain and highland, its highest summits range up to 14,000 feet and the lowest depression of the country is about 600 feet above the sea level. Two mountain chains, the Alps and the Jura, pass through and divide the country in many different sections, which show a great variety in climate and soil as well as in population and language. The main languages are German, French and Italian, a great many Swiss speaking at least two of them.

The Swiss confederation had a very extraordinary origin and development. In the year 1291 the inhabitants of three small districts called Uri, Schwyz and Unterwalden, dissatisfied with the manner in which they were treated by Austria, formed a confederation, the parchment of which is still in existence. These three nations have from that date always kept good friendship together, and never up to the present day has any divergency of opinion ever arisen between them; whatever occurred they always stood on the same side and assisted each

other. In course of time other districts or cantons joined those three, the last instance occurring in the middle of this century only, and so was formed the Swiss confederation as it exists to-day.

Switzerland has an area of 17,821 English square miles, and a population according to the last census of 1888, of 2,933,000. Only a relatively small portion of the soil is arable land, and though producing a great variety of things, it does not by far produce sufficiently for the Swiss population, and so it came that from the oldest times Swiss people went abroad on a large scale and under different conditions. Some went to foreign countries in order to get their living and positions there, others went to earn money and return home with it, others entered military service, others again went only temporarily in order to enlarge their knowledge of foreign countries and to keep up business relations.

The comparatively widespread relations abroad facilitated to a great extent the establishment and development of the various industries which were created in Switzerland and among which textile manufacturing played a great part. We find linen, wool, silk and cotton manufacturing in Switzerland in former centuries when all the work was done by hand. Linen manufacturing is known to have existed already in the ninth century in Appenzell, and woolen manufacturing is believed to be still older. Hemp and flax were cultivated on a considerable scale, and Swiss linen cloth had at that time a good reputation abroad; woolen goods were made merely for home consumption. Linen and wool manufacturing did not, with the exception of a few mills, develop themselves to large modern industries, and cotton and silk manufacturing have more or less taken their places.

It is unknown how far back lies the origin of cotton manufacturing in Switzerland, but it is certain that it has been carried on for centuries. The oldest document known is an interdict from the government at Zurich. This document dating from the year 1445, indicates at the same time that Zurich may be

considered as the cradle of the cotton industry of this country, as it is still to-day its most prominent business town. In order to explain how the government of Zurich came to enact such a law I must say that the cantons whilst forming a federation by which they engaged themselves to mutual assistance, conserved their independency for internal legislation, having even their own currency. It is only since 1848 that the confederation unites the cantons closer, and since then federal legislation has been more developed and has in many respects taken the place of cantonal legislation, uniforming thus the laws throughout the country. This has especially been the case with laws concerning industry and trade. Among the latter I wish to point out the federal factory law and the law protecting the work people against the consequences of accidents; on these laws I shall speak again later. In former times when textile manufacturing was still in its infancy, the views of legislators were very much different from those of our modern legislators. To-day manufacturing and trade are more or less free in all civilized countries; such was not the case then when the guilds played a large part and all what they considered infringing their rights was suppressed. Then again were there privileges of townships; the country surrounding a town was be to kept dependent upon the town and the latter was jealous not to allow certain trade or manufacturing being done in the country. The governments were anxious to secure and conserve to the inhabitants of their cantons the benefits derived from manufacturing, and they made laws and prescriptions as they thought best fit for this purpose. The cotton used in Switzerland came from the Mediterranean, from Greece, from Cyprus, etc., later on from the West Indies, from Brazil, Guyana and Venezuela. The cotton from the United States, Egypt and India came in this century only. It was brought on horseback over the Alps in bales of one to three hundred weight, and in a very unclean state; it was mixed with bolls, leaves, seeds, stones, etc., but on the other side this cotton had a good staple not injured by the gins of our days.

The first operation was to clean the cotton, which was done by hand, mostly by children, then the short staple cotton was carded and the long staple cotton combed. This latter was put in small flocks into paper, and the yarn spun out of it was called letter yarn. After the carding or combing the cotton came to the spinning apparatus which appeared in three forms. The first form was a vertical spindle; stretching and twisting was made simultaneously for about an arm's length, but then the work had to be interrupted in order to wind the yarn on the spindle and to fix it there with a ribbon, then the stretching and twisting began anew. With this wheel a skilled hand could produce very fine yarn which was sold under the name of spindle yarn till the end of the last century.

The second form was a horizontal spindle; stretching and twisting was also done simultaneously, but the work had not to be interrupted; the winding on the spindle was done simply by ceasing to stretch the yarn. This yarn, called wheel yarn, was inferior in quality to the spindle yarn.

The third form was the treadle wheel with the flyer. This form of spinning allowed continuous spinning, as stretching, twisting and winding up were effected simultaneously and continuously.

In this way was the spinning of cotton done in Switzerland until about the year 1810, when spinning by machinery came into use.

When cotton yarn was first made it was not for making cotton cloth alone, but it was used as filling into linen warp; by and by cotton cloth in warp and filling came into use. A very prominent part, plaid muslin (the name of muslin, originally mousselin, is from Mossul an industrial Turkish town on the Tigris) which was introduced here by French emigrants who came into Switzerland after the revocation of the Edict of Nantes by Louis XIV.

The cotton was imported by cotton dealers, who sold it bale by bale to spinning firms, who had the cotton cleaned and

carded or combed and gave it to yarn carriers who brought it to the spinners who lived by thousands at hour's distance nearly all over the country. They took the yarn back to the spinning firms or yarn dealers who lived mostly in Zurich, Winterthur, Lichtensteig, St. Gallen, etc. These latter sold the yarn again to the weavers, or had the cloth made on their own account, in which case they were called manufacturers.

A new impulse was given to the cotton manufacturing when the printing of cloth was introduced in Switzerland. The printing had its origin in India where it was practiced since the oldest times and brought to Europe most probably in the beginning of the seventeenth century by the Dutch, who began at that time to get colonial produces, spices, etc., directly from India in competition with the Portuguese who had up to that time the monopoly of trading in the Indian ocean. Among the Indian products they brought also the indigo and introduced it to the European trade. As the indigo was mostly employed for the printing of cloth it is supposed that the art of printing was introduced at the same time as the indigo. It is a fact that printing of cotton cloth came to a certain importance in the seventeenth century in France, and that the success was due especially to the beautiful indigo blue the French employed in printing.

When Louis XIV. revoked the Edict of Nantes thousands of French people left the country, taking with them their knowledge of manufacturing, and in this way many French industries were transplanted to foreign countries. Some of the refugees knowing the process of printing cotton cloth came into Switzerland and introduced this industry to our country.

It was in Geneva, Neuchatel and later on in Zurich where the printing was first introduced. In Geneva by the family Fazy from Nantes. In Zurich the government made some difficulty by not allowing any refugee to establish himself, but fortunately allowed them to enter the service of Zurich merchants and manufacturers. The Zurich people as a whole feared the superiority of those refugees in manufacturing and did not want to

have them among themselves. Some more clear sighted merchants however seized the opportunity to introduce new branches of manufacturing and to perfect old ones.

Those immigrants introduced also, as said before, the manufacture of muslin. As the first firm who introduced in Zurich "Indienne" and "Persienne" printing is named in 1701 Roemer & Kitt. Indienne was a printed cloth with simple and small designs. Persienne was the cloth with rich and large designs. By and by other firms began the printing and this industry became more and more important in spite of all the difficulties, especially those approved by the privileged guilds.

The colors used in those times were only red, white and blue, those being the only fast colors known. The operations necessary prior to printing, as singeing, shearing and bleaching were very troublesome, and already towards the middle of the eighteenth century the necessity was felt to introduce mechanical appliances, and on a petition the government of Zurich allowed in 1757 the introduction of calendar rolls, with the restriction however to use them cold and not warm.

The firm of David & Melchior, Esslinger, established a waterwheel for driving their calendars. This firm made handkerchiefs printed on both sides, which were known in France under the name of "genre zuricois." The indienne printing took a great development in Zurich and Neuchatel, and in 1746 skilled work people went from those places to Mulhausen in Alsace in order to improve the methods of printing practiced hitherto in that town. About at the same period was the printing also introduced in Glarus. In 1712 a parson from Zurich had taught the cotton spinning to the people of Glarus and some ten or twenty years after that date in the whole country of Glarus it could scarcely be found, same as in the Canton of Zurich, one house without one or more women engaged in cotton spinning. The government of Zurich looked at that with jealous eyes, being afraid that this competition might injure the income of the Zurich people, and tried by several decrees to make trade in

cotton and cotton yarn between Zurich and Glarus more difficult. Now when in 1740 the printing was introduced in Glarus by FATIO from Geneva, those sentiments arose again on the part of the Zurich government, but this anxiety proved idle as the Glarus printers made a specialty of indigo blue printed handkerchiefs, with simple and large designs, which did not come into competition with the class of work made in Zurich, which was more complicated in colors and designs. Not only was the population of Zurich in no way injured by want of work, but the income of the canton increased by the larger sums of duties paid (for the cantons raised duties on the goods entering their territories in those lines), as well as by the larger amount of tolls on roads and bridges, which resulted from the more animated traffic.

The printing spread more and more during the eighteenth century, and also improved in the quality of the product without reaching however the quality of the Indian prints imported in Europe by London firms.

A great event was the introduction of turkey red dyeing in Switzerland. The turkey red dyeing had long remained a secret of the east. In the year 1747 French manufacturers engaged Greek dyers to come to France and assist them in the establishment of two turkey red dye works, one in Rouen and the other in the Languedoc. The French were very glad to be no more dependent from the east for the turkey red cloth and yarn. The method of dyeing remained for some time the secret of the two establishments, but, in 1765 the French government published it in order to encourage the cultivation of the madder in the south of France. JEAN ALHEN was the first who began with the culture of the madder in Avignon. The culture of the dyestuff in France gave the impulse for the creation of new turkey red dye works in Rouen, Nimes, etc., and lead also to an improvement of the old method introduced by the Greeks. In spite of the publication made by the French government concerning the method of turkey red dyeing, it was very difficult

for foreigners to get acquainted with it. J. HEINRICH ZELLER, from Zurich, succeeded however, after having been engaged in the establishment of turkey red works in St. Nicolas du port, near Nancy, tried to do turkey red dyeing in Zurich, but the result was not quite satisfactory and he sent his brother to Nimes in order to learn it thoroughly. On the return of this latter in 1784, the two brothers founded turkey red dye works for cotton cloth and yarn under the firm name of Heinrich & Rudolf Zeller in Zurich. In order to give an idea of the importance of this industrial novelty it must be said that the colored weaving, which had begun to flourish since the middle of the eighteenth century, was compelled to buy the turkey red yarn in Marseilles, Rouen or Trieste, and that this yarn was often of inferior quality, so that in order to secure the required quality manufacturers had to send Swiss yarn to those towns to have it dyed there. The long time required by the dyeing process, combined with the long journey to and fro were such that the Swiss manufacturers had often to wait a full year before they got their yarns dyed back again. The colored weaving firms in the Toggenburg were therefore very glad to see this turkey red dye works established in Zurich and immediately became good customers. Also the printing firm of David & Melchior Esslinger of Zurich became a first rate customer, as it had its cotton cloth dyed red prior to printing, according to a new method just then invented. Discharge work on turkey red ground formed from this moment an important speciality of the Swiss printing. Spinning and weaving became more and more important, occupying thousands of hands, being in fact the most important source of earning for the Swiss population. When weather was fine and warm the spinners sat with their spinning wheels before their houses, mostly some united together, and the traveller could hear their singing from far and near.

The manufacturers made warps on balls of about a hundred yards, giving four pieces of cloth. For grey cloth they took the ends directly from the spun yarn. For colored cloth they had

the dyed hanks spooled in the dwelling houses of the neighbourhood, then placed the spools on a reel on which they formed the pattern of the warp. Those balls were given to the weavers along with the necessary filling in hanks, closely counted. The looms were put up in the cellars, the natural dampness of the latter being especially appropriate for the weaving of fine cloth; other looms were put up in the sitting room. The weaver beamed the warp up on his loom, drew it in through the healds or twisted it on, making the pattern. Then came the sizing; the dividing rods were taken out, the yarn was put on a level and sized with two brushes for the length between healds and yarn beam, then by a fan consisting of a wing on a rod, air was blown upon the wet yarn till it was dry. In evenings when the family and friends were united in the sitting room and a girl was still busy on her loom, a brother or a lover could be seen doing the sizing for her or spooling the filling bobbins.

About in 1790, began the importation of English machine spun yarn and this at such low prices that hand spinning got a very serious competition and its further spreading was at once checked. The English did, however, not only send cheaper yarns to Switzerland, but were also able to produce cotton cloth quicker and cheaper than before and it was evident to the Swiss manufacturers that they must either introduce also those cheaper methods of producing cotton goods or see their industry dying out.

First, now, the importation of English yarn became more and more important and the weaving in Switzerland was very flourishing. Two inventions aided powerfully, one was an improvement on the loom. Up to that time the shuttle had to be put in and taken out by hand, now a shuttle box was applied to each end of the lathe and the shuttle thrown across the shed with a kind of a picker motion, the weaver pulling a cord, as is still done in hand weaving. This mechanical lathe allowed the weaving of wider cloth, as the shuttle could be thrown across with more power, also was the production very much increased.

The second invention was a quicker method of bleaching cloth, which was done now in one, instead of four weeks.

DEVELOPMENT OF COTTON MANUFACTURING IN THE NINETEENTH CENTURY.

The introduction of mechanical cotton spinning was not easy as machines were not freely sold in England and their export was even forbidden, but this difficulty was finally overcome and in about 1810 cotton was first spun on mule jennies in Switzerland.

The establishment of spinning mills was relatively quick, some people bought first single spinning machines and drove them by hand, but soon water power was used and regular mills were erected. This brought great changes; in places where there was no water power, or no enterprising people, spinning died out. Many hand spinners took to weaving, others left their homes and settled down near the newly erected spinning mills. Not all of them would have been able to leave their homes and it was a great help to those latter that they could put the hand loom in the place of the hand spinning wheel, when about twenty years later the power loom came up and hit a sudden and heavy blow to the hand weaving; the change was not so easily overcome and serious disturbances took place.

The mechanical inventions followed each other very quickly in the first quarter and half of this century, so was introduced in about 1820 the Jacquard weaving on hand looms. I think I cannot do better than give hereafter some sketches of the lives of some of the most prominent men of that period, from which will best be seen how the development from hand manufacturing to modern manufacturing with machinery took place.

MATTHIAS NAEF was born in 1792 as the eldest son of a cotton weaver. From his mother he inherited love of labor, sense of honesty, economy and good order; qualities which are worth more than fortune alone. This good mother died however, when Matthias was eight years old, the father left a widower

with four children came soon into bad circumstances and took to drink; he was a weaver, the boys were spinning cotton and winding the filling bobbins. When MATTHIAS was ten years old he learned to weave; when his father left the loom, after having sized the yarn, and went to do the cooking, young MATTHIAS took his father's seat on the loom and tried to weave and by his own exertion he succeeded soon so well that his father formed the idea that he could employ his son not only during the time he was cooking but also when he found it pleasanter to go drinking than to sit on the loom, he was however, compelled to come home for the sizing, for which operation the arms of young MATTHIAS were yet too weak. The latter had already his own loom when he was in his eleventh year, and he earned to his father four florins per week. Nevertheless, there was no blessing in the household and all credit was lost. MATTHIAS with his motherly care for his younger brothers alone made ends meet. For some time the boys for want of proper apartments had to sleep in the stable with the cows and calves of the house owner. Finally the family was dissolved and MATTHIAS came with one of his brothers as a servant to a small farmer. There he worked on the land during summer time and in winter he wove linen and cotton cloth. His master gave him, besides food and lodging for him and his brother, for each piece of cloth a little present, and MATTHIAS NAEF became at the same time a clever worker on the land as well as a skilled weaver. He was faithful to his master and got a good reputation, esteemed by every one who knew him, but he had very little opportunity to go to school; in all he could not visit it for more than forty weeks. He learned a little reading and writing, but not to calculate and he felt his deficiency very much and tried to compensate it by himself as well as he could and was also taught by a fellow servant who had had a somewhat better instruction. After about two years he offered his master to pay for his boarding and to weave for a manufacturer, which was accepted. At Easter when he made his first communion he

possessed a new good suit of clothing and eighteen florins, the first florins belonging to himself and he counted them over and over again.

In 1811, he left his master and entered the services of a manufacturer, who paid him besides the boarding, five florins for each woven piece of cloth, furnishing him besides the warp on a ball, the spooled filling and the size. To other weavers outside his home this manufacturer paid for the same piece, twelve florins. An ordinary weaver made such a piece in two weeks. Matthias Naef finished it in one week and satisfied thus his master very much, for this latter got in this way pieces cheap and economized one week's board; he was, however, fairdealing, and raised the weekly pay of M. NAEF to eight florins.

NAEF soon obtained the reputation of being the best weaver in the vicinity, also he lost no time and often worked until ten at night. Earning now 200 florins per year, he yet was very economical. He was a tall, strongly built young man, very fond of open air recreation on Sundays and he never spent money for tobacco or other things that he considered of no use. In 1813 and again in 1815 NAEF was compelled to military service, which he liked very much and from which he returned both times to his loom again satisfied with what he had learned and seen in the country he came through. In 1816 he called already his own a capital of 1100 florins and resolved to get married and he married the servant girl of a manufacturer in the neighbourhood. This girl was honest and true, she had been eight years with the same master and had done besides all the housework, the warping of the yarn. She came with no other money or expectations than what she had earned during her service, but NAEF said, I have more chance of becoming a well-to-do man with a poor, but honest and intelligent wife, whom I love well, than with a wife I would take for her money's sake and who would have no idea of doing anything.

The first year of their marriage was a severe test to the young couple; nearly all the crops had failed in 1816 and all things

were very dear during the winter 1816-1817. NAEF had bought a small house with some land and a cow and he tried to come through as well as he could; he learned now how much his good reputation was worth to him, for it procured him credit. Naef was weaving, his wife did the housework, took care of the children and spooled the filling. In 1819 the manufacturer for whom he was weaving died and the widow assisted NAEF to become a manufacturer himself; she went with him to a yarn dealer in Oberutzwyl and recommended him there as a man to whom might be trusted a hundredweight of yarn and also did she introduce NAEF to a merchant in Herisau who ordered cloth of him. NAEF put up a loom for his brother JACOB and one for another good weaver and paid to each one eleven florins salary per piece. Those three men were weaving together three pieces of cloth per week, which he carried every Friday to Herisau, a distance of three hours; there he stopped not longer than was necessary and went home to his loom again. Each piece left him eleven florins, so that he earned, his own salary included, forty-four florins per week, and this was the foundation of his manufacturing. In 1821 his merchant in Herisan wanted NAEF to increase his production and there was also another merchant desirous to get cloth from him; this led him to reflections. He could scarcely hope to get so much credit from a yarn dealer as was required for six or eight looms and out of his own money he could only pay the healds and salaries of his weavers. But the idea how much more he could earn gave him courage and also did he think that the yarn dealer from whom he bought the yarn now, bought it also from the second hand and it would be advisable for him to go to the first source as the wealthier manufacturers did, who bought the yarn in St. Gallen and Winterthur. NAEF went to St. Gallen and entered the first yarn store he met and bought one hundredweight of No. 40, which he took home; on examination he found it better in quality and even cheaper than the yarn hitherto bought in Oberutzwyl. A few days after he went again to St. Gallen to the same store,

supplied with a mortgage on his house, which he handed to the merchant as security against three hundredweight of yarn. When he came the next time to buy yarn the merchant gave him the security back and told him that he had informed himself and knew that he was honest and that he was willing to give him credit without security.

NAEF made only grey cloth, which he sold mostly in St. Gallen, Herisau and Zurich, where he went by foot, carrying often some pieces of cloth on his back. When his production had increased to such a proportion that it amounted to a horse load once a week, he bought a horse and wagon.

NAEF now began to do colored weaving and established a small dye works, enlarging constantly the size of his business, which now required commercial book keeping. Hitherto he had sold his goods to the Swiss merchants, and the responsibility he now felt compelled him to look out for other business relations which offered better guarantees for regular and constant work, and he went in for consignments. In 1835 he built a jacquard-weaving mill; the looms of course worked by hand; and in 1838 a spinning mill; then he put up machines for finishing the woven goods. The colored woven goods required much more finishing at that time than to-day. NAEF now bought the raw cotton and sold the finished goods to Turkey, Egypt, the East and West Indies, etc., and the trade mark and name of his firm soon became honorably known, ranking among the best.

MATTHIAS NAEF was, besides a very intelligent manufacturer and business man, a very good citizen; he died in 1846. His concern is now carried on by his grandsons, under the firm of Naef & Co., in Niederutzwyl; it has 360 power looms, weaving colored goods, a spinning mill and finishing works.

HEINRICH KUNZ, from the canton of Zurich, was born in 1793, and at the age of seventeen he was in Alsace where he got acquainted with the new spinning machinery, and he perceived the importance cotton spinning was going to have. He wrote to his father that he heard with interest of the establishment of

cotton mills in Switzerland, but was sorry that he himself had not taken any steps yet to erect a mill. The father took up the idea, and already in 1811 he erected spinning machines. HEINRICH KUNZ sent machines and parts of machines from Guebweiler, and left Alsace towards the end of the year in order to take the management of the concern at home. For some time he carried the product of his spindles in a bag to his customers in order to learn from them how they criticized the yarn. In the year 1816 KUNZ resolved upon erecting a new mill in Oberuster, and this mill was running two years later and formed the foundation of the further development of the firm. In 1850 KUNZ had already about 145,000 spindles, and paid per year from 600,000 to 700,000 francs in salaries to his 2,000 work people. KUNZ died in 1859. The firm changed its name which is now Wunderly, Zollinger & Co, formerly HEINRICH KUNZ, in Zurich.

In 1873 the firm had 219,000 spindles, which produced 3,500,000 pounds of yarn at a value of eight and one-half million francs; the salaries paid were 1,300,000 francs. In 1882 the firm had 245,000 spindles which produced 5,800,000 pounds of yarn at a value of nine and one-half million francs; the salaries paid were 1,800,000 francs.

The disproportion between the value of the production of 1873 and 1882 results from the fact that in the latter year lower counts have been spun than in 1873, and also that the prices of cotton yarns have been generally lower in 1882 than in 1873.

This firm is the most important of all the Swiss cotton firms; it has now 252,956 spindles in several mills. About 80 per cent. of the work people live in families, and 20 per cent. are single persons. The firm has supplied accommodations for hundreds of families at low rents.

CASPAR HONEGGER was born in 1804, in Ruti, canton of Zurich, where his father possessed a small property.

In 1810 the father undertook, with the aid of some work people, the opening and cleaning of cotton for the spinning firm of

Braendlin Brothers in Jona near Ruti. In 1814 the father entered into partnership with a friend for the erection of one spinning machine, to which were soon added several more and a regular small mill was erected driven by water power.

In 1818 the father took the spinning concern for his own account. This mill had now 2,000 spindles, which was then considered to be one of middle size. The more important functions were executed by the members of the family; father and mother, sons and daughters, all worked at the mill and the earnings were good. It was worked day and night at the mill, and CASPAR, though scarcely ten years old, worked regularly from eight at night till seven in the morning. From eight to eleven in the forenoon he visited the school in the parsonage; wearied with his regular work he often fell asleep there. The afternoon was mostly given to rest, but sometimes even then he had to do some work in house or field. So it went on for several years. CASPAR became very clever in the handling of the machines; at the age of fifteen years he was already the foreman over the whole mill. If to work and economize was the motto for old HONEGGER and his family, he wanted it also to be the motto of his work people, and already in 1812 he founded a small savings bank for his work people.

In 1826 CASPAR HONEGGER married and his father retired from business, while he and a brother took the concern, which had grown in the meantime, for their own account, with ideas of further development. They bought land along the Jona River, in order to secure the water power, enlarged the spinning mill, and thought of erecting a mechanical weaving mill, but the introduction of the power loom encountered some difficulty.

In 1830 it was still fresh in the memory of the population how quick the spinning machine had made the hand spinning disappear, and the hand weaving was just in a very flourishing condition in the canton of Zurich, and when in 1831 a mechanical weaving mill was erected in Uster, people expressed their fears of losing their industry. Dissatisfaction became soon wide-

spread, and on the occasion of festivities in Uster on the 22d of November, 1832, a number of excited hand-weavers and mob went to the said weaving mill and burnt it down, hoping to check in this way the movement of erecting new mills, and in fact for some time nobody ventured to put up mechanical looms in the canton of Zurich, during which time the English and French erected weaving mills very rapidly, and made with their mechanical woven goods a very serious competition to the Swiss hand-woven goods, either for cheaper prices and better quality.

CASPAR HONEGGER and his brother resolved to erect a mechanical weaving mill now outside of the canton of Zurich, and in 1834 they found a suitable opportunity in the canton of Schwyz, not very far from Ruti. There they erected a mill of 50 looms, but as they were Protestants — the law did not allow Protestants to be proprietors in that canton — the mill had to be registered on another name, a Schwyz citizen, who became their partner.

The concern made its way under serious difficulties; no skilled work people and even no work people willing to go to the mill; difficulties and heavy expenses to secure the water power; the river was at times very wild, overflooded the country doing great damages — this required very costly levees. CASPAR HONEGGER took the management of this mill, though he had up to that time never seen a mechanical loom. The first loom came from Paris. HONEGGER studied it and improved it soon very considerably, and this led him to establish a small workshop where he made the looms himself. These looms were far better than the looms made at that time in England and France and their reputation spread quickly.

In the year 1838 CASPAR HONEGGER and his brother separated, CASPAR took the concern in Siebnen, canton of Schwyz, and his brother took the spinning mill in Ruti. CASPAR HONEGGER enlarged his own weaving now to 200 and later to 400 looms. Political disturbances caused him however to remove his workshop to Ruti.

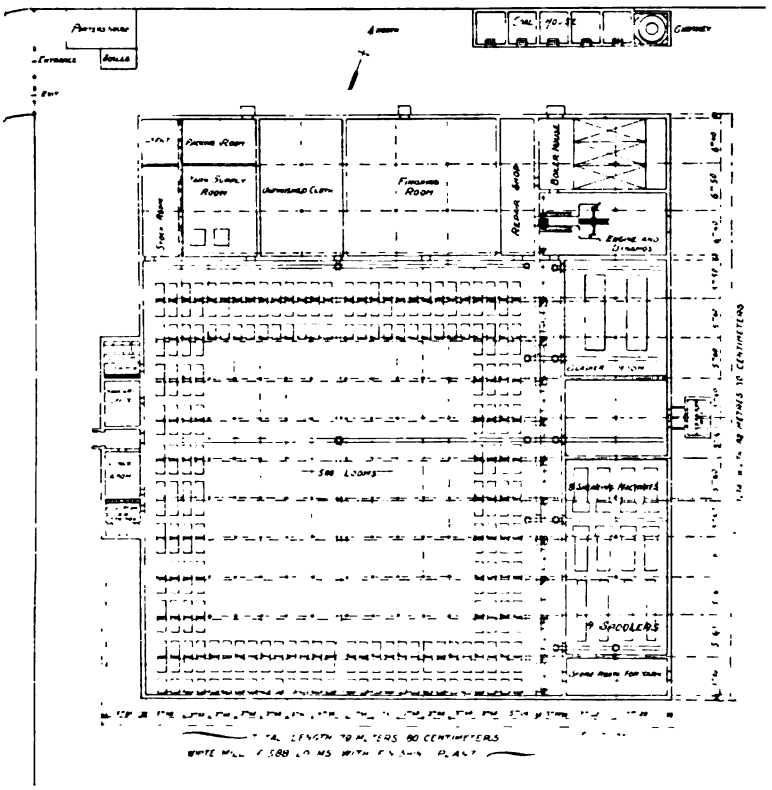
In 1852 HONEGGER erected a spinning mill near to Siebnen, but before this, in 1846, he bought a very considerable water power in Kottern, Bavaria, where he erected a large spinning and weaving mill managed by his son-in-law. Not only did he build the mill, but also a great number of houses for his work people, and soon also a school for over a hundred scholars. In 1870 Mr. FRIES, the son-in-law died, and HONEGGER made, a few years after, a stock company of this concern, which employed over a thousand people.

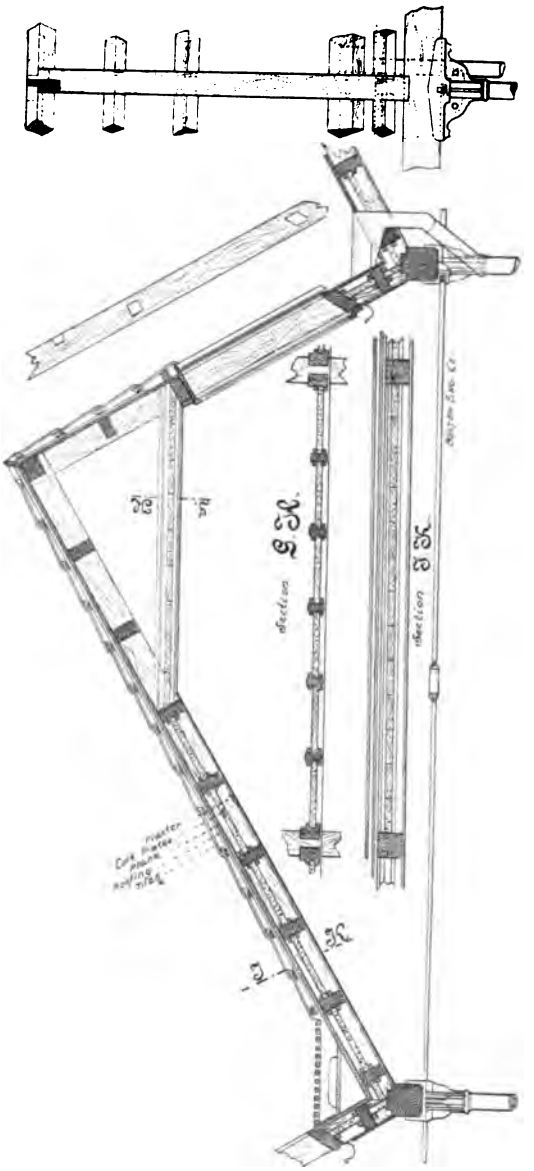
HONEGGER had transformed Siebnen and Kottern from small poor places to large and flourishing industrial communities. More and more also Ruti developed itself to one of the most prosperous villages of the canton, thanks to the energy of CASPAR HONEGGER who had laid the foundation with his HONEGGER looms. The reputation of his looms spread so rapidly that HONEGGER had soon to enlarge his works in Ruti. At first plain calico looms were made, then he constructed drop box looms, which he sold against the sharp competition of the English loom makers.

CASPAR HONEGGER died in 1883. His firm took the name of Maschinenfabrik Ruti, formerly CASPAR HONEGGER, and makes now looms for silk, cotton, wool and linen, along with the preparation machinery and transmissions of power. These machines are sold to-day to all countries of the European continent, and there is one fact noteworthy — the firm very seldom took patents. One of the partners told me once on my inquiry, it is better to make looms good and sell them cheap, than to secure their sale by patents.

CASPAR HONEGGER was not only a very clever mechanic and business man, but also a good man and citizen, and his work people and the communities where he lived keep him in good memory for his generosity towards them.

I add to this paper a complete plant with details of a modern weaving mill furnished by this firm, along with reproductions of its sizing machines and of a 4 x 1 box loom.


Boiler House
Engine and Dynamos
Finishing Room
Yarn Supply Room
Unfinished Cloth
Stock Room
Receiving Room
Cleaner Room
Spooler's
Sewing Room for Looms
Chimney


Section
Section
Section
Core master
Frame
Roofing
Tiles

The firm of J. J. Rieter & Co. in Winterthur, was founded in 1790. It started with colonial produces, then traded in cotton and hand-spun yarns, and began in 1806 to import English machine-spun yarns.

During the continental blockade, when Germany was occupied by French troops, J. J. Rieter & Co. bought in London 200 hundred weight of American cotton, with the instruction to send it by water to St. Petersburg, and from there overland to Winterthur. This enterprise succeeded after numerous difficulties.

In 1812 the firm erected the still existing spinning mill in Buchenthal near St. Gallen.

In 1814 the trade in colonial produces was given up and the import of English yarns carried on a larger scale.

In 1824 the erection of the spinning mill was begun at Nieder-Toess near Winterthur, and the machines for this mill were mostly made by the firm itself. The appliances required and procured for the making of these machines induced the firm to begin in 1828 the making of spinning machinery for other people, and in 1831 the first complete set of cotton spinning machines was delivered to a firm in Austria. The workshops of the firm became successively more important, and were partially transferred in 1853 to the ancient convent in Toess. The works were constantly enlarged and produce now annually about 200,000 spindles with the preparing machines.

This firm, whose name is now Actiengesellschaft, formerly J. J. Rieter & Co., in Winterthur, is actually the only one in Switzerland making spinning machines, which rank among the best in the market. It makes also embroidery machines, tools, transmissions, and as a specialty turbines, also dynamos for light as well as for transmitting power.

HEINRICH RIETER, born in 1814, was for many years the principal head of the firm. He brought the machine making to a considerable height, laying the foundation of its further development. RIETER had no special technical education, but was thoroughly experienced in cotton spinning by the manage-

ment of his own mills, and he worked himself up to one of the most distinguished industrials of this country.

In 1871 RIETER retired from business, leaving the management of his concern to his sons.

Shortly afterwards the Swiss government appointed RIETER commissioner-general of the Swiss section of the World's Exposition in Vienna in 1873. The Centennial Exposition of 1876, in Philadelphia, brought RIETER also in relations with the United States, as the Swiss government appointed him also Swiss commissioner-general of that exposition. His advanced age obliged him, however, much against his wish, to direct this enterprise from his home, and to leave the work of installations in Philadelphia, and the representation there of this country to a younger man.

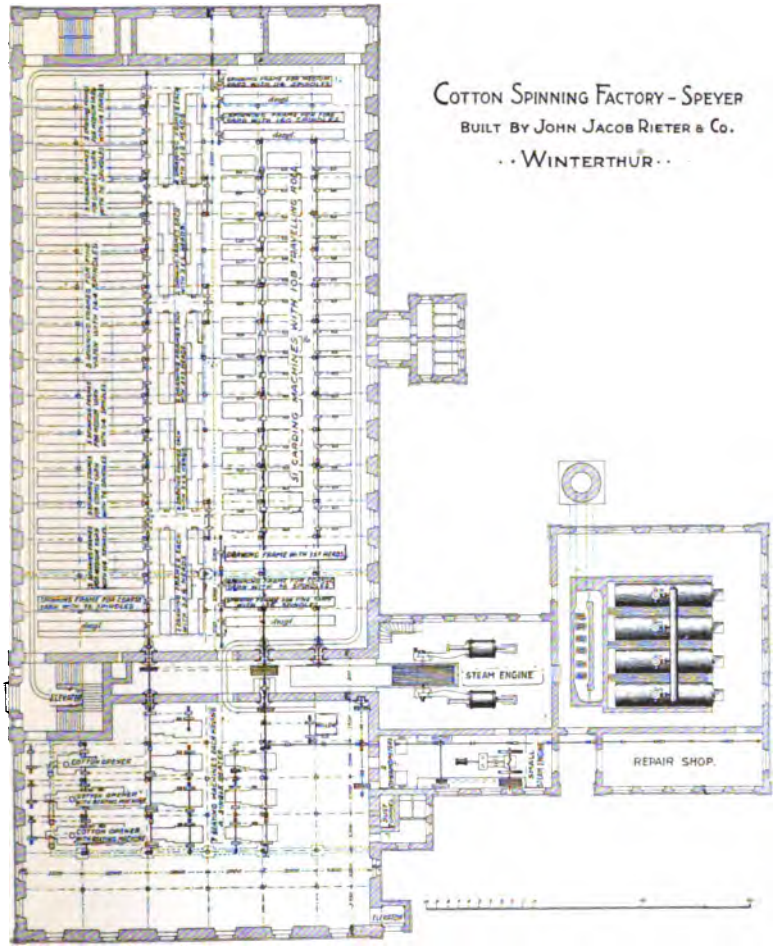
In 1878 RIETER was elected a member of the council of the Swiss States, in which quality he rendered very valuable services to his country as president of the permanent custom tariff commission. HEINRICH RIETER died in 1889, in Berne, during the session of the council.

I add to this paper a complete plant of a modern spinning mill of 25,656 spindles, which is however not situated in Switzerland, but in Speyer, Germany, but the machinery was supplied by this firm. This would be the type of a cotton spinning mill in this country if a new one was erected.

One of the oldest Swiss cotton manufacturers was my father's grandfather, JOH. SCHWEITZER, born in 1731. When a half-grown lad he left home with a few coins in his pocket, and began the hawking trade, especially with handkerchiefs. He came as far as Bale and there became acquainted with several important business people.

In 1750, having earned a small sum, he settled down in the Hof near Lichtensteig, canton of St. Gallen, and began to manufacture himself, besides trading in cotton and cloth. He was very successful; the acquaintances made while travelling aided him powerfully.

Erdgeschoss



I. Stock
II. Stock
COTTON PILES
CONVEYING APPARATUS
COTTON PILES
PICKER
PICKER
PRESS
Langschnitt

He died in 1798, and his son, my grandfather, JOH. CONRAD SCHWEITZER, born in 1767, continued his business. When, after the first quarter of this century, the colored weaving was very flourishing and began to use unfast colored yarns, which allowed more variety of the designs and were also cheaper, my grandfather thought that customers would soon find out the inferiority of those goods and return to the old solid qualities again. This did not, however, happen, and he lost by and by his business relations.

In this same way and at the same period many manufacturers gave up business. Another number of them remained behind when the mechanical weaving of colored goods — about 1855 to 1860 — came up.

Of course hand weaving could be done on a smaller scale and with less means than mechanical weaving, so that the number of firms who could follow the progress became naturally more and more limited. Among these latter I mention the firm of Birnstiel, Lanz & Co., in Wattwyl, of whose establishments I add a small view. The founders of this firm were JOSABE RASCHLE and his son RUD. RASCHLE followed about the same course as MATTHIAS NAEF, occupying at times thousands of hand weavers. The firm has now about 500 mechanical looms, making colored goods for all parts of the world in very great variety.

The industrial development of Switzerland was much influenced from the political events in Europe in general, and from the commercial policy of the neighboring countries in particular.

The situation of Switzerland was in one way very unfavorable. The raw material had to be transported a long way from the seaports, and the fabrics again had to find their markets mostly abroad. In fact, Swiss manufactures and especially textile goods, are sold to all parts of the world. This is very wonderful considering that the Swiss industry was left to itself without any protection.

We have duties now and were obliged to have them in order

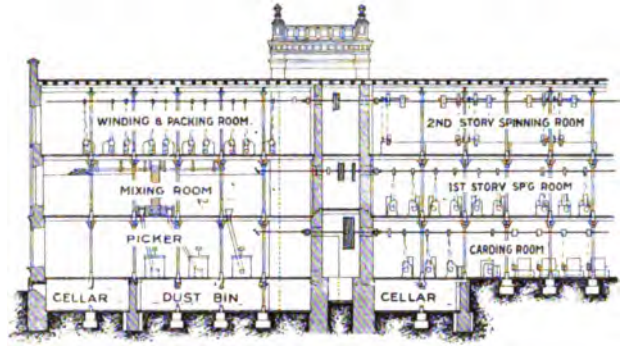
to be able to negotiate commercial treaties. Our duties are low and we would be glad to do away with them entirely if our neighbors would do the same.

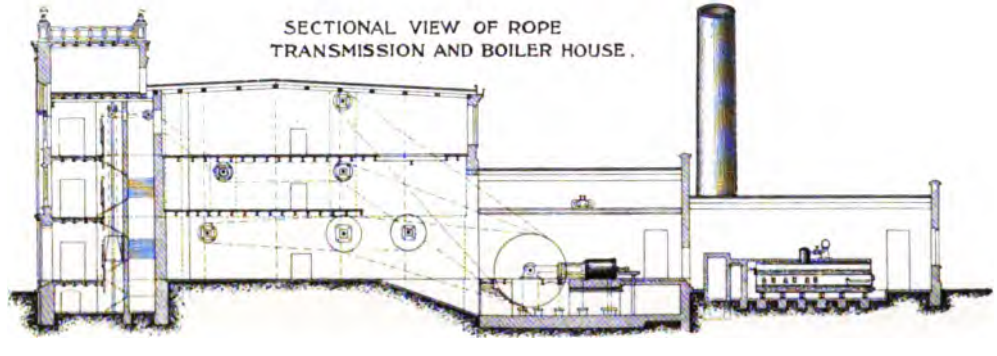
The adoption of the free trade principle for Switzerland has been fully justified by the experiences made with it. France was the first country that adopted protection in the beginning of this century. This carried a heavy blow to the Swiss industry, but the Swiss manufacturers, to whom the French market was almost entirely closed, soon found full indemnity in markets across the sea. The same thing happened when the German States formed the Zollverein with protective duties.

There is one great item to be noted: when our neighbors closed their markets to our goods they allowed us free transit to the seaports, thus granting us the access of the foreign markets. This state of things had two results. The first was that the Swiss manufacturers took measures to be enabled to produce goods for the consumption of all the countries in the world; this required enormous detail, but brought better prices and assured constant work, as trade was never bad at the same time all over the earth.

The second result was that many Swiss people went to the neighboring countries in order to found mills there, and many of them took soon a leading position among the manufacturers of the respective countries.

There is, however, one branch of cotton manufacturing which was almost entirely expatriated by its own development — it is the printing of cotton cloth for dress goods. If Switzerland produces goods of great variety, its consumption of goods, especially finished goods, must naturally be small and of great variety, according to the variety of climate and population. Now the printing of dress goods with the enormous production the new machines give, must necessarily have a home market of some importance, and as such a market does not exist in Switzerland, it happened that in Alsace the printing of dress goods took an enormous rise, whilst in Switzerland it died away.





SECTIONAL VIEW OF ROPE TRANSMISSION AND BOILER HOUSE.

Printing of cloth is still done in Switzerland, especially in the canton of Glarus, for handkerchiefs and other specialties. Switzerland is the country for using the water as power for industrial purposes, there are so many streamlets and rivers with considerable fall, which invited to the erection of water-wheels and turbines. The mills were therefore erected along the streamlets and rivers out in the country, and not united in towns as in England. The consequence of this was that there did not, or only in rare exceptions, form itself a population of mere work people. Manufacturers themselves are mostly also land owners and have it cultivated. Many of their work people bought land and have houses of their own; many of the mill-hands are sons and daughters of peasants, whose parents are glad to get in this way some cash income. Many of those who came to the mills as boys left after some years and learned a profession. Many people work on their land during summer time and come to the mill for the winter.

A considerable portion of the mill-hands are of course dependent for their earnings from the mill and being settled down; having in many cases their own house and property, these people cannot easily go to work at another mill for a time, they remain where they are or go away entirely. This circumstance compels the Swiss manufacturers to keep their mills running even at a loss. At times prices may be so bad as to leave actual loss so that it would be less ruinous to stop production entirely, but as in this case the work people would be obliged to leave the place, it would be very difficult to re-open the mill again when better prices might be obtained. The total suspension of work at mills is therefore a rare exception, and also partial reductions very seldom take place. If this is in one way a disadvantage, it allows on the other side more settled conditions of the work people. Many of them remain their lifetime at the same mill and the relations between them aud their employers are as a rule friendly. The former see in the latter generally not only the employer but also the one to whom they can take refuge for assistance and good advice in any emergency.

The mills were generally built on a small scale, say 10,000 spindles or 200 looms, for which the existing water-power was sufficient. Then new machines, requiring more power, were put in or the mills were enlarged, and the wanted power supplied by steam, so that to-day most of the mills using water-power have steam engines besides, which are used as auxiliary and supplementary powers, as the quantity of water of most of our water currents is irregular. The turbines mostly used here are Girard system; they are well adapted for the using of irregular quantities of water.

To-day the water-powers are used either directly on the spot or transmitted at distances by electricity.

PRESENT STANDING OF COTTON MANUFACTURING.

There are existing now about

a. 1,600,000 spinning spindles, of which the largest number belonging to one firm is 252,956. The largest number of spindles in one mill is 100,000.

b. 35,900 twisting spindles, of which the largest number belonging to one firm is 9,000.

c. 15,000 looms for gray goods, of which the largest number belonging to one firm is about 800.

d. 8,000 looms for colored goods, of which the largest number belonging to one firm is about 500.

There are about 80 spinning firms, of which 27 only have spinning and weaving together, though never in the same building. Most of the spinning is done on mules, as mule yarns are generally preferred, and also because ring spun yarn is more difficult to sell on account of the wooden bobbins. Most of the Swiss cotton mills are private companies and only a few are share companies; the number of the latter is, however, increasing. Hand weaving is still done on a small scale; the number of looms varies and on the whole diminishes. In all cases mechanically sized or dressed warps are given to the hand weavers. Hand weaving is done for colored and fancy articles which are too complicated for mechanical weaving, or for small

orders of long terms of delivery. Hand weaving is very unreliable for the delivery, as the looms are neglected when there is much work in the fields. This is of no more importance to-day, but in early times formed a most tedious difficulty to manufacturers, often preventing them from fulfilling their contracts.

The yarn is numbered on the English system and sold in cops per kilo and in bundles of ten English pounds.

A considerable portion of the yarn is exported, mostly in bundles in the raw or dyed state.

The cloth is sold per meter; the width is given in centimeters and the quality is named by the number of ends per quarter of a French inch, and the count of the yarns, for instance: 80 c. m. 19-17, 38-44, means cloth 80 centimeters wide, 19 ends warp and 17 ends filling per quarter inch, 38th warp and 44th filling.

The gray cloth is exported in great quantities, especially to Germany, "in admission temporaire," that is, admitted free of duty into Germany for being dyed or printed, but it has to leave the German territory again before a certain term, unless the full duty is to be paid.

The Alsacian printers pay the duty on the quantities sold, dyed or printed in Germany, but the main quantity is exported again inside of the fixed term, to all the countries of the world.

Cloth reserved for Swiss consumption is also sent in this manner, duty free, to Germany, with the permission of the Swiss custom office to enter free again into Switzerland after having been dyed or printed. The colored woven goods are also mostly for export, and I think I may be nearly right in saying that about one-third of the looms for gray as well as for colored goods, weave for home consumption, and about two-thirds of the looms weave for export.

The twisting spindles make mostly twist for embroidery, also twist for healds and sewing cotton.

Hereafter I give a list of salaries paid in our mills, also list of prices of victuals, for boarding, etc., from which may be seen how our people find their living. I add also some more statistics of interest.

SALARIES PAID IN SWISS COTTON MILLS PER DAY OF ELEVEN WORKING HOURS.

For Spinnsng Mills.

	Francs.
Overseer,	5.00 to 6.00
Engineer,	5.00 " 6.00
Fireman,	4.00 " 5.00
Head machinist,	5.00 " 6.00
Machinist,	4.50 " 5.00
Carpenter,	4.50 " 5.00
Out-door man to haul cotton bales, etc.,	3.50 " 4.00
Night watchman,	3.50 " 4.00
Pickerman,	3.50 " 4.00
Grinder,	3.50 " 4.00
Stripper,	3.50 " 4.00
Card-room man,	3.20 " 3.80
Drawing tender (av. earning),	2.80 " 3.20
Roving " " "	2.80 " 3.20
Spinner, " "	4.00 " 4.50
Minder,	2.00 " 2.50
Back-boy,	1.70 " 2.20
Oiler,	3.20 " 4.00
Cleanser woman,	2.20 " 2.80

For Weaving Mills.

	Francs.
Overseer,	5.00 to 6.00
Overseer's assistant,	3.50 " 5.00
Spooler-tender (av. earning),	2.50 " 3.00
Warper- " " "	2.80 " 3.20
Slasher- "	5.00 " 6.00
Slasher-tender's assistant	3.50 " 5.00
Drawing-in girl (av. earning),	2.50 " 3.00
Girl to examine cloth,	2.20 " 2.80
Folder,	3.50 " 5.00
Clerk,	5.00 " 6.00
Weaver (av. earning),	3.20 " 4.00
Filling-bobbin carrier,	2.50 " 3.00
Oiler,	3.20 " 4.00
Dresser-tender,	5.00 " 6.00
Dresser-tender's assistant,	3.50 " 500

MOTIVE POWER IN DIFFERENT BRANCHES OF TEXTILE INDUSTRY IN 1888.

Denomination.	Number of Establishments Using as Motive Power.						
	Water.	Steam.	Water and Steam.	Gas.	Electricity.	No. Motors.	Total.
Cotton Industry,	229	84	182	(10)9	—	1067	1571
Silk Industry,	72	75	45	3	—	32	227
Woolen Industry,	30	2	14	—	1	—	47
Linen Industry,	7	1	2	—	—	1	11
Other Textile Industries,	27	29	6	7	—	53	122
Total,	365	191	249	(20)19	1	1153	1978

PRICES OF VICTUALS, ETC., AND FOR BOARDING, RENT, ETC.

Article.	Price per	Francs.
Milk,	liter	0.18 to 0.20
Bread,	kilo	0.32 " 0.35
Flour,	kilo	0.40 " 0.50
Beef,	kilo	1.60 " 1.80
Butter (fresh),	kilo	2.50 " 2.70
Cheese,	kilo	1.50 " 1.80
Eggs,	dozen	0.90 " 1.20
Salt,	kilo	— 0.12
Rice,	kilo	0.50 " 0.70
Macaronies,	kilo	0.60 " 0.90
Chocolate,	kilo	2.00 " 2.50
Sugar,	kilo	0.60 " 0.90
Tobacco for smoking,	kilo	0.80 " 1.50
Coffee,	kilo	2.50 " 3.20
Soap,	kilo	0.80 " 1.00
Petroleum,	liter	0.40 " 0.50
Potatoes,	kilo	0.06 " 0.08
Wood for heating,	hundred kilos	2.00 " 2.50
Apple cider, retail,	liter	0.20 " 0.30
Wine, retail,	liter	0.80 " 1.20
Beer, retail,	liter	0.40 " 0.50
Boarding, single man,	two weeks	18.00 30.00
Boarding, single woman,	two weeks	14.00 20.00
Rent for small house with 4 or 5 apartments and land for vegetables,	two weeks	6.00 14.00

COTTON INDUSTRY IN 1888.

Denomination of Establishments.	Total Number.	With Motors.	Motive Power, Horse Powers.					Number of Workpeople.						
								Total.			Over 18 years.		Under 18 years.	
			Total.	Electricity.	Gas.	Steam.	Water.	Total.	Female	Male.	Female	Male.	Female	Male.
Spinning,	110	110	22006	—	—	4610	17396	13025	6335	6690	5097	5386	1238	1304
Wad Making,	2	2	14	—	—	—	14	13	2	11	2	11	—	—
Waste Working,	3	3	53	—	—	20	33	15	1	14	1	13	—	1
Twisting,	56	56	1033	—	—	220	813	1195	1001	194	834	163	167	31
Grey Weaving,	79	75	4760	—	—	1221	3539	8767	6450	2317	5338	1953	1112	364
Colored and Jacquard Weaving,	52	49	2202	—	½	634	1567½	5876	3746	2130	3229	1835	517	295
Embroidery by Machinery,	1051	3	31	—	1	10	20	16721	8636	8085	6922	7326	1714	759
Chainstitch-embroidery,	6	4	14	—	—	10	4	88	76	12	69	12	7	—
Shuttle-embroidery,	82	82	467½	—	13	216	238½	1111	938	173	717	118	221	55
Dyeing,	36	33	730	—	—	607	123	1222	218	1004	180	915	38	89
Printing,	27	27	1309	—	—	420	889	3878	1771	2107	1617	1917	154	190
Bleaching, Singeing, Finishing,	67	61	1537½	—	7	880½	650	2247	742	1505	686	1435	56	70
Total,	1571	505	34157	—	21½	8848½	25287	54158	29916	24242	24692	21084	5224	3158

SUMMARY OF HOUSES FOR WORK-PEOPLE OF SWISS FACTORY INDUSTRIES IN 1892.

Name of Canton.	Number of Houses with			Total			Average of People in One Dwelling.
	One Dwelling.	Two Dwellings.	More than Two Dwellings	Of the Houses.	Of the Dwellings.	Of the Inmates.	
Zurich,	235	182	266	683	1887	9315	4.9
Berne,	101	49	67	217	579	2997	5.2
Lucerne,	7	5	32	44	185	967	5.2
Uri,	2	—	—	2	2	4	2.
Schwyz,	1	3	6	10	33	145	4.4
Obwalden,	—	—	1	1	4	16	4.
Nidwalden,	2	2	—	4	6	46	7.7
Glarus,	28	21	36	85	300	1651	5.5
Zug,	7	18	47	72	240	1078	4.5
Fribourg,	—	—	3	3	18	88	4.9
Soleure,	6	16	51	73	351	1596	4.5
Bale,	64	97	125	286	746	3469	4.6
Balecountry,	9	14	2	25	41	235	5.7
Schaffhouse,	7	7	10	24	75	438	5.8
Appenzell, A. Rh.	1	4	5	10	40	191	4.8
Appenzell, I. Rh.	—	—	—	—	—	—	—
St. Gallen,	65	103	119	287	794	3665	4.6
Grison,	2	—	7	9	36	172	4.8
Aargau,	38	13	49	100	432	2267	5.2
Thurgau,	54	26	46	126	348	1580	4.5
Tessin,	—	—	—	—	—	—	—
Vaud,	—	4	6	10	45	239	5.3
Valais,	—	—	—	—	—	—	—
Neuchatel,	4	10	16	30	103	493	4.8
Geneva,	—	—	—	—	—	—	—
Total,	633	574	894	2101	6265	30652	4.9

I add to this report, as mentioned before, plants of modern spinning and weaving mills. Most of the existing mills however, date from former periods, are old buildings supplied with new machines. In order to show the old types of mills, I add a view of a spinning and weaving concern situated in Waengi Thurgau, which belonged formerly to my father and his brothers-in-law. This spinning mill was built in 1824 and is one of the oldest in the country; the weaving mill is ten years younger. The spinning mill, formerly of about 10,000 spindles, now about 8,000 spindles, has five stories. The ground floor has three divisions: the first is the mixing room, the second is the picker room, and the third is a magazine for yarn and supplies. The second story is the card room in which the machines were symmetrically arranged and placed in rows parallel to the length of the building. From the picker room the laps were carried to the card room by an elevator. Eight or ten cards in a row formed a set; the slivers of the breaker cards went down to a trough which carried them to a lapping machine at one end of the row. These lapping machines made laps of which six or four were placed behind the finisher cards, the laps from those cards were placed on the first drawing frame, and there the slivers were again formed into laps. These laps came to the second drawing frame and the laps from this machine came to the third drawing frame, but on this machine no laps were made; the slivers were delivered separately by a coiler motion. A bottom plate pressed against the coilers with weights and the slivers had to surmount this pressure. When full these slivers, wound in coiler form, were removed and placed behind the slubbing frames. There were intermediate and roving frames and the bobbins of the latter were carried by a man, called the bobbin carrier, to the spinning machines of the third, fourth and fifth stories. I say spinning machines, for there were say forty years back, no self-acting mules but hand spinning machines. These machines had about 350 spindles and were placed square, their length in the narrow side of the building. With these machines

the carriage came only automatically, the winding back was done and then the machines stopped, and the spinner had to drive the carriage in, guiding at the same time the winding wire. With these machines a skilled spinner could make very good, especially very fine yarns, as he could give it just the tension he wanted.

Some mills had a little later so-called semi-self-actors, by which the spinner was dispensed from driving in the carriage; but these machines did not spread much as very soon the mules of our days came up. The mules, being much longer than the hand spinning machines, had to be placed in the length of the building, and this did generally not allow to place the same number of spindles as before.

The cards were generally flat cards without licker in; one or two pairs of fluted cylinders delivered the cotton to the cylinder. This mill construction has one great disadvantage, the picker room being placed below, endangers the whole mill in case of fire outbreak, which is not so seldom in picker rooms.

The spinning mills built after the introduction of the self-acting mules, are of a different type, which I show by the view of the Murkart spinning mill. This mill, of about 16,000 spindles, belongs to a stock company and was built by my father in 1864; it is now managed by myself.

The view shows only the main building, of which the ground floor is the card room, and the second and third stories are the mule rooms.

The carding was at first double; the slivers of the breaker cards were united to quarter laps for the finisher cards on special doubling machines. The double carding is just now in process of being replaced by the single carding with revolving flats.

The mules are placed with their length to the narrow side of the building. Behind the main building and separated from it by a thick wall and iron doors, is the second building. The ground floor is divided into two parts, the one against the yard is the mixing room and the other the picker room. In the latter

is a powerful fire hose from a pump driven from the transmission, which would fill this room in a few instances with water. Above the picker and mixing rooms there is a room for roving frames and another for weighing the yarn and putting the cops into boxes.

In the third story is the reeling room and a room for bundling.

Behind this second building there is a one-story building for the turbine, steam engine and workshop.

About ten years ago a district railway was established on the road passing before the mill, and the cars come into the yards, bringing cotton bales and coal to the mill and taking the yarns away.

This mill construction is the modern one and about the type of the mills erected of late years.

A mill of this size employs more hands than a mill of equal size in the United States, especially in the mule rooms. Each pair of mules has a spinner, one minder and a back boy or piecer. Sometimes with spinning of finer counts one back boy works three mules.

The weaving mill in Waengi has three stories. The first and second are for the looms and the third is for spooling, warping, slashing and drawing in. The construction of this mill is in one way advantageous — the transmission is below the ceiling of the ground floor, the looms of the latter are driven from above and those of the second floor from below, and only half the transmission is required than with shed construction. Most of the Swiss weaving mills for gray cloth have this construction, with the difference that the newer ones have higher stories and windows than this one has.

The colored weaving mills have also three stories or have a ground floor for the looms with a narrow second story for the preparing machines. The roof over the ground floor has on both sides windows, giving light to the looms from above, and the construction is made so as to allow this light to reach the

looms placed in the middle of the room. There are also some weaving mills, for colored as well as for gray cloth, with shed construction.

There is nothing special to be said about the gray weaving; about the colored weaving there are some particularities to be noted. All the yarn is dyed in hanks; after having been spooled it is warped on two different systems. All the yarn is sized on the dressing machine. Now one system of warping is on beams, same as for gray cloth, with the difference of the pattern made in warping. With this system always eight beams are made of which four are placed on each side of the dressing machine. The other system is the sectional warping; narrow sections of about five inches are warped, and on each, when full, the division is made. These sections are put on beams of which two are placed on each side of the dressing machine. Each of these beams with sections corresponds thus, in consequence of the division made on the sections, to two of the beams of the first-named system.

Most of the looms for colored or gray weaving have overpick, some have loose reed and some fast reed; all have iron breast beams and iron crank arms. All the machines of spinning and weaving mills are devoid of the showy colors of the American machines; they are painted mostly black and green as in England.

There is nothing noteworthy to be reported on Swiss mill construction besides what has been said or what is to be seen from the illustrations. I may say only this, the erection of a cotton mill is very costly in Switzerland. It requires a considerable lot of land for the mill with the canals and dwelling-houses for the work people. Then comes the cost for making the canals, buildings with machines, etc., the double expenses for the turbine and steam engine; and the working of the latter is very costly, as we pay for coal actually about 29 to 33 francs per ton.

I add to this report copies of the complete series of federal

laws concerning the factories, of which the main prescriptions are:

1. The maximum working day is fixed at eleven hours, with one hour less on Saturdays.

2. The age under which no child is allowed to work in factories is fourteen years.

3. Women having given birth to a child are not allowed to work in factories for two weeks before and six weeks after the birth of the child.

4. The mill proprietors are to some extent liable for the accidents with which their work people meet and have to indemnify them.

There are insurance companies in Switzerland which insure against the consequences of accidents, but there is actually a federal law in preparation by which the insurance against accidents and illness will be organized by the confederation.

NOTE.—The photographs and drawings referred to in this paper are on file in the library of the Association.

TOPICAL QUESTION.

8. How many looms do Swiss cotton weavers run on fancy weaving, either Jacquard or dobby? Also, what numbers of warp and filling in same with speed of loom?

Mr. ARNOLD SCHAER. I have had but very short notice to prepare as good an answer to the question before us as I wish to, and I can therefore answer them only from recollections which date back some years. The Swiss manufacturers, although they carry on business on what we should call a small scale, are very progressive and they are fully alive and up with all the improvements in machinery and methods brought out among themselves and their neighbors, as they make it their practice, each individual manufacturer as well as their Manufacturers' Association as a body, to send experts into foreign countries to keep posted on all the points wherein improvements could be introduced.

The speed of machinery in general in Switzerland is about the same as in England. Looms are kept up to what we should call high speed, going on the principle to get all they can out of the machines, and letting the help, owing to the rate of wages being lower, run less looms. Weavers never run more than four looms, mostly two, and often three; and the average speed, if my recollections serve me right, is 200 picks for 40 inch looms, 36 inch looms are run about 10 per cent. faster and 50 inch looms 10 per cent. slower. I understand that mills with the most modern looms run their looms even faster. The looms are invariably built with the over-pick motion, and loose or fly reeds, which undoubtedly admits of higher speed than our style of fast reeds with daggers and bunters, and under pick.

Fancy looms with dobbies are run about 10 per cent. slower than plain, unless few harnesses are used, when the speed would be the same as on plain. Jacquards are run 145 with single lift machines and 165 with double lift for weaves with brocade effects, damasks, etc. The double-lift machines are generally

used, but where lace effects are wanted the single-lift machines are preferred. The questions as to what numbers of yarn are used is a difficult one to answer. Mostly fine yarns, say 60—100 warp, 70—150 filling, but of course there are also weaves for domestic uses, such as ginghams, handkerchiefs, toweling, sheeting, where numbers are used way down to 6s, hence the correct answer will be, all possible numbers are used. The Swiss cotton industry, although small in comparison with Germany or England, is very diversified, but its general tendency is towards the finest products, owing to its geographical location and heavy freights. Their principal markets are Germany and America, and fully three-quarters of their product is for export abroad.

There is still some hand weaving carried on in the more remote mountain districts, such as fine lace designs, chain-stitch work, small loom weaving and embroideries. This hand loom weaving is carried on as a house industry, the weaver owning the bare loom, and the manufacturers furnish warp, harnesses and filling, and see to the proper adjustment of the looms. But this industry is gradually dying out, only the most difficult weaves are done in this way now. Weavers are paid by piecework and the basis is not as in England, an old established price list, but is based on the quantity that can be produced, on the same principle as here. A first class weaver can earn per week $4.00, but the average is probably not over $2.50. As a basis for calculation I should say a weaver ought to earn per loom per week of 66 hours, on plain work, $1.00; on hard plain work and fancy, $1.25; on Jacquard, $1.50.

In general I wish to state that the figures given above apply not only to Switzerland, but also to Southern Germany, comprising the states of Baden, Wurtenberg and Bavaria, where cotton manufacturing is mostly carried on by Swiss manufacturers, and under the management of Swiss. The adverse tariff legislation of the neighboring countries, Germany, France, Austria and Italy, has had a very disastrous effect on the Swiss

cotton industries, and the more prosperous and progressive manufacturers have found it necessary to establish mills in Germany and Italy, in order to keep their capital employed. In the southern part of Germany the cotton industry has of late years made great progress, owing to the above stated cause, in the establishment of new mills, which was almost exclusively done by Swiss capital and Swiss managers, who are virtually driven from home by the wall of protection which has been built around them.

TESTS SHOWING POWER REQUIRED TO DRIVE VARIOUS WIDTHS AND MAKES OF LOOMS.

Contributed by various members. Read by Mr. CHARLES H. FISH.

Lawrence Manufacturing Company. Number of looms, 30; width, 86 inches; make, Lowell; picks, 158; cloth, 4 yards, 36-inch sheeting, 56 x 60; looms per horse power, 5.95.

Ponemah Mills. Width, 40 inches; make, Whitin; running on leno, 16 harnesses, width in reed, 29 inches; number looms per horse power, 4.43; same work on box looms (number of box not stated); number looms per horse power, 2 3-12; fancy dobby looms, 11 harnesses, width in reed, 30 inches; number looms per horse power, 5.63; same looms on box work, number looms per horse power, 4.75; same looms on light lawns, width in reed, 33 inches; number looms per horse power, 6.96.

Stark Mills. Number of looms, 1,000; 40-inch looms running 160 revolutions per minute on heavy sheeting; number looms per horse power, 2.92; 36-inch looms, running 170 picks per minute on standard sheeting; number looms per horse

power, 3.20; 30-inch looms, running 180 picks per minute on standard drills; number looms per horse power, 3.50.

Naumkeag Mills. Make of looms, Mason; 80-inch looms running at 100 picks and 96-inch looms running at 95 picks per minute on wide sheetings; looms per horse power, 3.17.

Pierce Manufacturing Company. 1,320 looms divided as follows: 450, 40 inches; 256, 36 inches; 614, 32 inches; looms all running on plain fine goods, four harness, light sley and pick; looms per horse power, 7.23.

Wamsutta Mills. 994 looms, 48 inches, running 157 picks; 80 looms, 45 inches, running 152 picks; 800 of the 994 looms are running on standard Wamsutta shirtings; 194 looms are running on plain shirtings similar to Fruit of the Loom; the 80 45-inch looms are running on high pick sateens 96 x 180; looms to horse power, 5.22.

Everett Mills. 312 33-inch Whitin looms, 3 harnesses; 28-inch goods, single shuttle, running 160 picks, used 50.64 horse power, or 6.16 looms to the horse power.

160 40-½inch Crompton (4 x 1) box, 158 picks, running with 2 harnesses and using 3 boxes, 27-inch goods, required 58.19 horse power, or 2.75 looms per horse power.

80 old Thomas side cam 33-inch looms, running 133 picks, 2 harnesses, 2 boxes, 27-inch goods, required 12.39 horse power, or 6.46 looms per horse power.

Would say that we indicated the engine three or four times under each condition, so as to get a fair average, and there was not much variation, so that we feel the tests show quite accurately the power required for driving looms in this mill.

The PRESIDENT. Those members who were at Atlanta will remember, as I do with great pleasure, the very interesting paper by Mr. JEROME HILL. Mr. HILL is here to-day with a

new kind of cotton bale. I suggested that he speak to us in regard to it, and he said he thought it would be too much in the line of advertising. I told him if he had a decent bale of cotton there was no advertisement I would better like to help along, and I know you will be glad to have Mr. HILL tell you about it.

THE "AMERICAN" COTTON BALE.

Mr. JEROME HILL. No body of men has ever visited any section of this Union that gave the people whom they visited more pleasure than did the visit of your Association to the South, when you visited it on your journey to Atlanta and return. I only regret that you could not have extended your trip farther, and believe you should have crossed the Mississippi River and seen the great West, your home-consumers. As General DRAPER has just stated, you all are pretty much of one political opinion, so I extend to you an invitation to come out to St. Louis in June, when you nominate your next President.

Now as to this bale of cotton here and its many benefits, I wish to state to you that I have given this matter much study. I was born on a southern plantation, and for the last quarter of a century have been handling cotton, from the fields to the spinners. During all this time I have been connected with producing, baling and marketing cotton, and have been and am still interested in the present Morse & Taylor systems.

Six years ago I visited Europe, and like most Americans, was thinking of and expressing my opinion as to the greatness of our country. A friend of mine on the docks in Liverpool agreed with me about our many wonderful resources. He called my attention to the enormous docks, but said he would now

show me an American disgrace. It was a cargo of American cotton being unloaded. Its condition was much to be deprecated, and I really felt ashamed of it. Since that time I have been looking into the ginning and baling of cotton for the market. We have had a great many experiments, and under the Morse & Taylor systems we have made some improvements from the old original gin plants, one of which I now have on a plantation in West Tennessee. This cylindrical bale, when presented to me, struck me as being the thing we have so long desired, and after personally testing the matter in every way for nearly two years, with many improvements, I firmly believe that it is a success and a permanent revolution in the marketing of the American cotton crop.

I assert to you that with this system we can take a bale of cotton from a southern plantation, and after compressing it in one of these cylindrical presses, the same can be delivered to Fall River, Providence or Lowell mills at a net saving to the planter, transportation company and consumer of from three to four dollars per bale.

I beg to state here that there is a gentleman in this city of Boston who has had more to do with the agitation and pushing forward of this bale of cotton than any other American. I have reference to the Hon. EDWARD ATKINSON.

I hope you will not think I am a promoter, for allow me to say that it is the first time in my life I have ever endeavored personally to bring before the manufacturers any new process of marketing farm products.

It is now conceded by the best informed mechanical experts that the cylindrical bale of cotton will supersede the old and faulty square bale system.

The savings estimated on an average American crop to the planter — compressing, transportation, insurance — and to the manufacturers, will amount to $30,000,000 annually.

This process will do away with two handlings entirely: first, the old and laborous labor of the plantation press; second, the

hauling and concentrating and compressing under the present Morse & Taylor system.

It will make American cotton the best prepared cotton for commerce and manufacturing in the world; heretofore it has been the worst.

The saving from sampling, purloining, etc., as under the present system, will be from 30,000 to 40,000 bales annually. This loss heretofore has been sustained by the *planter* and the *manufacturer*.

It will do away with screwing the cotton on ship-board as the gain in density alone will be 30 per cent.

It will injure the fibre of the cotton vastly less than the old method. It will do away with false-packed cotton. It will do away with the old inflammable and worthless 22 to 24 pounds of jute bagging and iron ties, and the freight on same, now being paid by the consumer.

It will substitute an ideal commercial bale for the bale that Mr. EDWARD ATKINSON now calls "the most atrocious, barbarous, unsafe, wasteful and unsuitable package in which any staple of commerce is put any where."

It will conclusively prove that this system justly deserved the gold medal given at the Cotton States Atlanta Exposition, where our plant on exhibit received the applause and approval of all the cotton people, both manufacturers and planters.

It will make the production of cotton a pleasure to planters, instead of one of endless labor as now. The time and labor saved to them will be beyond computation.

It will prove, as in other industries, that the greatest economy and satisfactory results can only be obtained by wise, skilful concentration of large and perfect systems of cotton ginning, condensing, compressing and delinting of seed.

It will reduce the insurance on cotton, both in this country and Europe, fifty per cent.

It will be of vast importance to the railroad companies, enabling them to market the American cotton crop with profit to

them of an expense estimated at from one to two dollars per bale, as it will place for transportation 80 to 100 bales of cotton in every car versus 25 bales of the planter's pressed cotton, and 48 to 52 of the Morse & Taylor compressed cotton.

But last, and not least, it will bring to the cotton spinners of the world a protection and benefit that nothing else save this assured revolution could have possibly brought. They save the cost in the value of cotton on 22 to 24 pounds of bagging and ties; they will participate largely in the freight and insurance saving; they will have a guarantee from a company of unquestioned responsibility that every bale of cotton they purchase will be full up in grade, free from sand and dust, free from mixed packed, free from false packed; in fact, they will receive a solid roll of cotton, perfect for manufacturing purposes, in lieu of the present cotton which is one of questionable quality and mixture.

It is a revolution, and worthy of its name—*American*. No invention has been presented to the country so full of assured success, and that will be such a boon to the cotton interests of the country, as *The American Cotton Company*.

It is not a theory or experiment, but *an assured success*, proven by practical and satisfactory results in a commercial sense during the marketing of the last cotton crop.

There has been some complaint of this cotton being hard to unroll at the core, when it is delivered to the mills. I am happy to state to you that we have overcome that defect and that what we are now putting up will unroll as easily as a roll of carpet.

The bale that I present to your Association, as you will see, is put up in paper — or, as the manufacturers call it, sulphite. We can cover it with cotton canvas or with this new covering, sulphite, in one sheet. It will be a most beautiful package. The manufacturers of this product claim that it will be almost fireproof and waterproof.

It is the purpose of our company to erect plants and endeavor to give you, out of the growing crop, a half a million bales the coming season. We propose to offer to the consumers a stand-

ard bale of cotton, just as we now have standard barrels of flour, pork and other products.

As to the weight of these bales, we can make them anywhere between 300 and 600 pounds to the bale. But our intention is, for this year, to make them 400 pounds; 4 feet long and 24 to 26 inches in diameter. This will allow us to ship you 125 bales in each standard railroad car, or say 50,000 pounds, if the railroad can carry that much. All cotton will be graded before it is ginned. This will do away with "mixed packs" and "rejections," and we hope to be able to make our shipments direct from the stations on the railroad and steamboat landings to the American cotton manufacturers.

Each press has an automatic sampler that takes from the bat as it moves from the condenser to the rollers of the press, three samples: one from the centre, one from the bale when half completed, and one from the outer circumference. It is the first cotton that ever has been perfectly and properly sampled. These samples are certified to and the cotton is sold and guaranteed to come up to same.

Inside the bale of cotton will be found a duplicate certificate, with name of plant, date of compressing, and number of bale, all corresponding with sample by which you have purchased. And the company will guarantee it to you until you have consumed same.

I ask your Association to give this great improvement your careful and considerate attention. I feel assured it is to your interests, that it is to your benefit in manufacturing and to your profit.

This cotton cannot be packed while wet, and it will be to the interest of the American Cotton Company to see to it that it is even running and not mixed or false-packed. Probably you are unaware of the fact that the southern planter does not store his cotton in his home or barn, for fear it will catch afire, and not only burn the cotton up, but his buildings. I am glad to state to you that the difference between the old square bale of cotton

and the improved cylindrical bale is simply this: if the first ignites you can never put out the fire; this last bale of cotton you cannot set on fire. It is, you might say, a fireproof bale.*

The PRESIDENT. This session stands adjourned until tomorrow morning at 10 o'clock.

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*The miniature bale is in the office of the Association.

MORNING SESSION.

10 A. M. APRIL 30, 1896.

Meeting called to order President GOODALE in the chair.

The PRESIDENT. The first paper on our list this morning is by a gentleman who has given a large part of his time to technical education in the manufacture of textiles. The title of the paper is "Technical Education in the Manufacture of Textiles," by Mr. EDWARD W. FRANCE, Director of the Philadelphia Textile School, and I take great pleasure in introducing Mr. FRANCE to you. (Applause.)

TECHNICAL EDUCATION IN THE MANUFACTURE OF TEXTILES.

Mr. EDWARD W. FRANCE, Philadelphia, Pa.

Never before, perhaps, in the history of textile manufacturing in this country, has technical education, its needs and its importance, both as a public duty and as a matter of self protection, been more generally or more earnestly discussed than at the present time, and never before, perhaps, has there been such a need for superior intelligence and artistic skill in our

labor, and in the manipulation of raw materials to their finished product, than at the present time. The query naturally arises, what has been the cause of all this discussion. The question can, I think, be truthfully answered by saying that it was brought about not only by the decay of the apprenticeship system, but also by the constantly increasing demand for higher and finer classes of production, coupled with the growing pressure of international competition under the new industrial conditions, which the factory system has fastened upon modern civilization.

Consider for a moment what is meant when we say that the apprenticeship system no longer exists. It means, that the agencies by which for centuries the generations of men have been trained who have done the work of the world wherever skill, knowledge and experience, were required, have ceased to be; and that such skill and craftsmanship and such knowledge of the principles which underlie all success in industrial processes as are possessed by the modern producer, or are to be possessed by those who come after him, are to be acquired by other agencies than those which fashioned the minds and trained the hands of the long line of his predecessors. In olden times an apprentice in the textile industry requiring any degree of skill was obliged to serve an apprenticeship of seven years. This system was in vogue in all the countries of Europe during the Middle Ages, and was rendered effective by establishing and rigidly enforcing a regulation that no person could sell his wares or products at the appointed places unless he had served his regular apprenticeship. At that time all wares were sold, especially in the great cities, in halls owned by associations called "Guilds." For several hundred years the associations exercised a powerful influence over their respective trades and governments. These were the most important places for the sale of goods; but if the maker had not served his regular apprenticeship, he could not bring his goods to them, and the best markets were not open to him. This mode of selling goods determined the mode of

manufacture or production, and created and maintained the apprenticeship system.

Much has been said concerning the decay of this system, by many it is seriously regretted. It must however, be remembered that there was a dark side to the apprenticeship system, employers were not always regardful of the interests of their apprentices, and many a bitter tale has been told of their experiences. If, therefore, the advantages of this system have passed away, with the changes that have come over the industrial world, let us not forget the evils accompanying it have also disappeared. The beginning of the end of the system came with the invention of labor-saving machinery, and the rise of the modern factory. At first the employer took his materials to the mill and worked them into final form by his journeymen, paying for the use of the machinery, thus the mill was only an appliance for him to make his products more cheaply and quickly. This system lasted for quite a considerable period, but finally another class of employers arose, who not only owned the mills they built, but employed those who occupied them in the work of production. Thus the old time employer with his journeymen and apprentices disappeared from the scene, and the mill and its appliances became a single enterprise owned and conducted by one man or an association of men.

The next change which came over the industrial world was in the rule previously mentioned requiring the producer of the goods to serve a seven years' apprenticeship before his production could be admitted to the hall for sale. This occasioned considerable controversy. The term was shortened however, first to five years, then to three, and finally disappeared altogether. The guild halls were then closed and the goods were sold on their merits, with less regard to the names of their makers. It is true that in many cases these were regarded as they are now, but the introduction of machinery wrought a great revolution, and was a great leveller in this sense, that the average quality of productions has been greatly improved. The machine

often does so much and better work than a man, that the old criterions of workmanship have changed. Even the most skilful woollen cloth maker by the old hand process could not make as fine cloth as can be made in the modern factory.

Perhaps the widest departure in consequence of the destruction of the apprenticeship system, and the rise of the factory system, is the decline in the interest taken by the employee in his work. Under the apprenticeship system, the apprentice often became a member of the employer's household, and was therefore directly interested in his prosperity. The apprentice felt that his success depended upon that of his employer, and this was true; he was in a sense a partner in the business.

In these modern days this close relationship and interest do not exist. While it is true that the prosperity of the employed depends also upon that of the employer, yet this condition of things is not so keenly felt as when the most thriving employer employed only a few apprentices or journeymen, in comparison with the thousands that a modern employer not infrequently employs in his factory or other enterprise. The existence of so many under his control from the very nature of things separates him from them. In many cases they do not know him personally, in fact they rarely see him. From this social and moral estrangement very naturally springs a lessened interest in the prosperity of his business.

The fact that machinery performs such a large part in modern industry, also lessens the interest of the working man in the manufacture, until today the boy goes into the factory and learns to manipulate certain machines. What the underlying principles governing these machines are, why they work as they do; what are the relations of one machine to another. If he learns anything of this at all, it is by chance. This is especially the case in the manufacture of nearly all kinds of textiles, and to this end every workman becomes, as it were, a part of a machine; without elasticity; he has no acquaintance with preceding or succeeding operations, and his value as a working factor is thereby

limited. The result of this contracted scheme is death to originality or artistic cleverness in the workman and true esthetic quality in the production. On the other hand, (and it must surely be apparent to even the casual observer,) owing to the great and growing demand for the newest and best productions that can be created, that in many branches of our industries, and especially among those on whom devolve the duties of supervision and direction, the standards of qualification are being raised, and make constantly increasing demands on the intelligence and ability of the men on whose efforts the character of the product depends. Moreover, an awakened sense of responsibility for, and of public interest in the quality of the productions of industrial communities, as distinguished from the more selfish interests of those immediately engaged, has transferred much of the discussion regarding these matters from the field of private affairs to that of public concerns, until it has become in a sense everybody's business to promote in all legitimate ways the prosperity of the community and the efficiency of its members.

Of the agencies that have come to be relied upon to serve this public purpose, industrial education is undoubtedly the one which has claimed the first place, and which deserves the most serious consideration. The people of America, even the great manufacturers themselves, are learning more or less rapidly this important lesson about the tariff on the adjustment of which so much reliance has hitherto been placed. They are learning that industries that have been protected by the tariff only, are only half protected, and that in numberless instances they are not protected at all, because they see that no matter how high the price may be made by the tariff, the consumers will continue to pay it if the imported wares are really better than the home product.

In glancing over the textile imports for the year 1895, I find that the American people imported upwards of one hundred and fifty million dollars' worth of goods, manufactured of cotton,

wool and silk, and I think it can be truthfully said that the bulk of this vast amount of importations were of the highest order of manufacture.

I do not say, or even deny, however, that some of these goods were not of such a character as to be classed as above; but the convincing fact remains that we are constantly receiving the very best expression of artistic thought as developed by the technical schools of France, Germany and England, and in some instances made from raw materials which are as cheap in this as in any other country (cotton for instance).

So that the way in which the industrial interests of this country have failed to be promoted by the means which we hitherto employed, suggest the necessity of additional methods. The past experience has clearly shown that even a McKinley tariff alone is futile against the competition of superior skill. In spite of the highest duties the best goods will command the market, and the real competition which our textile manufacturers have to fear, is not so much from the cheap labor of Europe that we hear so much about as from educated labor educated to its particular line. Now the only real way to meet this competition it seems to me, is not only to have a tariff in dollars and cents to cover the difference in our labor, but we must have also that protection which springs from the cultivation of our powers, and leads to not only happy expressions of thought in line and color, but to a thorough mastery of all the details of the art. Our textile workers, but more especially our designers, overseers, dyers, and superintendents, must be trained as only modern methods can train them, in a knowledge of approved methods and the reasons for their approval.

The foundation for such training should be laid broad and deep, and I would therefore build it upon the basis of higher education, believing, as I do, that the very best talent that we can bring to our aid is none too good for the textile industry of this country; but while touching on this point, let me say a few words on what I strongly feel has been one of the mistakes of

our higher education. One of the serious mistakes of our higher education in too many cases it seems to me, has been that it has not had coupled with it some form of manual employment. There has been a great unwillingness for example on the part of those who graduate from our high schools, and other schools of similar character, to become textile workers, while if they had never pursued their educations in such institutions, and gone into the factory, they would doubtless have gotten on better at least, would have been more contented, but the education they have received in these schools, in many cases has had the effect of leading them away from the work which they were perhaps better fitted to do, or which they could obtain, and of leading them to seek employment in stores and counting rooms where they could keep their hands clean, although receiving small pay, and with little hope of ever acquiring anything more than just a comfortable living. The education which has wrought such a result is sadly defective; happily the error is now clearly seen, and many of our institutions are supplementing or preceding their instruction on lines of some form of manual work; but manual training schools are not trade schools, nor professional schools, their function is to prepare boys to enter into trade or professional study. They serve as developing schools, where pupils may discover their innate capacities and aptitudes. Their object is not, and should not be, to graduate mechanics any more than to graduate manufacturers, lawyers, or journalists. Manual training schools should be stepping stones to trade and technical schools. They should stand in the same relation to the trade school as the high school does to the university or college.

Unless the boy has been trained to grasp the importance of such subjects as "the economic uses of steam", "mill equipment", "fire prevention", "transmission of power", "electrical engineering" and many other similar matters of equal importance to the successful manufacturer of today, his education is just so far deficient, and when the day does come for him to

take the direction of the craftsman he will ofttimes attempt to introduce economies at the wrong end, if he attempts them at all. I do not deny that there are men who have become very wealthy and who have never had the advantages of such an education as that to which I refer. Some of these men today take the position that as they were successful it is not necessary to educate our rising generation in any other way than that in which they were brought up. I wonder if it has ever occurred to such men that times and conditions have changed, and the requirements of the hour are far different, were they perhaps to start to-day under the same circumstances they would become dismal failures.

The textile industry of the United States has reached enormous proportions and it is still growing. I believe we can point with pride to the fact that we have some of the largest and best mills in the world. The equipment of some of our modern mills have perhaps no superior in any land. All the world long ago gave us the credit for our great ingenuity in machinery construction, but having said this, I am also forced to admit that the productions from this aforesaid machinery are sadly deficient in an artistic sense, in design, color and finish.

It does not follow, however, that we should put the blame on the designer in all cases for these poor results, for ofttimes from a lack of knowledge of limitations on the part of his superiors, he is compelled to attempt the production of a fabric from a copy of some fine foreign stuff, in a coarse material the stock of which is of such a composition that it will neither dye nor handle anything like what is desired, and the result is pronounced a failure. Could his superiors have been trained men, I believe, such cases would rarely occur. I do not mean to imply by this that there are not individual manufacturers throughout the country who have successfully grappled with the inherent difficulties of the situation, and have perfected their organizations to such a degree that would enable them to produce goods in every way equal to foreign productions, but this is the exception and not the rule. We have in America today perfected our machinery

to a most wonderful degree of proficiency, all our energies in the past have been to this end, overlooking the fact that the best machine we have is the human machine, and from a textile educational standpoint, comparatively nothing has been done to improve it.

That we are beaten in our markets by European manufacturers in lines of production on which we have come to depend for most of that which makes for the graces of existence, goes without saying. Now these graces of existence are the things which it is but worth our while to work for; they are the things whose service pays us best on whatever ground, and in whatever terms our profits are calculated and our reckoning made. It will pay us to look closely at the reasons for the success of our most envied competitors and to bend such energies as we possess to overcoming the disadvantages under which we are laboring today. Perhaps it would not be out of place to consider for a few moments to what an extent the question of trade education has been carried by our European rivals.

It was my good fortune a few years ago to make quite an extended tour through Europe, in view of looking into this trade school question. I found that the system of technical education in vogue was everywhere eminently and practically outspoken in its aim. Technical and trade schools abounded on all sides, of all kinds and methods. Trade education has taken a deeper and firmer root in the great industrial centres of the continent, than we on this side of the Atlantic would commonly realize. Indeed, there are special schools for the teaching of everything, from the making of shoes, and training of house servants, to the making of the highest classes of textiles.

The origin of these trade schools was, no doubt, the direct outcome of the rise of the factory system, and the inability of boys being able to learn trades in the old way. Thoughtful men saw that there were no places for the boys in the shops as there used to be; they saw that the owners or managers had no time to instruct them, and that the workmen were disinclined to do so,

because they were regarded as future competitors with themselves. The number constantly increased who could find no place in the factory, and even those who were fortunate enough to be privileged to learn, labored under many difficulties. By the establishment of these schools, however, things have become different; the relations between the teacher and the pupil are changed; he is taught by a person who delights to teach; there is no competition between the two. The teacher is, or should be, interested in conveying the best possible information, and try to make the pupil as proficient as possible. At first the idea was to train up men who should be competent to occupy the posts of responsibility and direction in the mills and factories. There is a limit, however, to that class of employment, no matter how intelligent it may be, the gradual enlargement of the scheme has followed, so that now the aim is to afford the same facilities to the workman in every branch of mill work. Europe depends as much upon these schools for leadership in her skilled industries, as we depend upon the sun for light, and upon the earth for food. Go with me into almost any district of Europe with which a special industry is identified, and I will take you to a trade school where that industry is thoroughly and practically taught.

France is undoubtedly ahead of all Europe in its generous provisions for popular, higher, special and technical education. It may also be said that she was the first country that earnestly set herself to extend the advantages of such instruction to the masses of the people. The vast expansion of her trade school system and the general introduction of manual and industrial training into the public schools, has been productive of incalculable good. French artisans and their work have been made famous for excellence the world over. In France drawing and modelling are among the most important subjects taught to all children in elementary schools. In the towns there are art galleries and night schools where free instruction in art is given to all who will have it. In Paris alone, there are from eighty to

one hundred of these free drawing schools, and it is not an uncommon thing to see posted all along the thoroughfares large posters calling the public's attention to these schools and urging them not to neglect the great opportunity they afford. A French statesman once observed, "we attach more importance to drawing and modelling than we do to reading and writing, for a man can go through this life without reading and writing, but he will have to earn his living by the use of his hands, and in proportion as he can use them skilfully and tastefully so will be his power of earning wages."

In Germany the schools are hardly less conspicuous as a part of the machinery of the government, than the army itself, and this is saying a good deal; not the primary, or at most, the high school alone as with us; but the technical, scientific, the trade, and the art school. The purely textile schools of Germany are among the best of their kind in the world. The government weaving school of Crefeld is about the foremost. It was started in a very humble way as early as 1855, and continued to do a most wonderful good for the manufacturing community up to the time of its reorganization, which took place about 1878. The Chamber of Commerce finding that the silk industry, the principle industry of the town, was languishing in consequence of the superiority of the products of other countries, particularly France, in designing, dyeing, and weaving, petitioned the government of Prussia for an inquiry, which resulted in the forming of a commission of four members, two from the State and two from the Chamber of Commerce, being sent to the seat of the textile industries of France to study the causes of their superiority. The commissioners reported that the improvement in French industries had been materially promoted by the technical schools, and schools of design established in French manufacturing towns, and recommended that the old Crefeld school should be completely reorganized and established in appropriate buildings. This was done with a lavishness and expenditure of money that would be amazing to Americans. Dr. Grothe, in

his account of the project, states that the school is to serve as a specimen school for Germany, and is intended to promote to an equal extent all branches of the textile industries.

To effect this object no expense was, or will be, spared by the government or the local authorities. The higher weaving school of Chremnitz may be cited as another textile school of no less value to the government of Saxony than the Crefeld school is to Prussia. It was founded in 1856, forty years ago, and has been of inestimable value to the trade of the town and district. The examples set by these institutions have been extensively followed throughout Germany, until to-day every textile district has its chemistry, dyeing, and weaving schools. These district schools have been established mostly for the operative classes and are open on Sundays and evenings. A manufacturer from Saxony said, only a short time ago, "let the government take its hand from behind the trade schools and we maaufacturers would support them ourselves. They are indispensable in helping us to keep what we have, and enabling us to go out and get more." And what is true of Germany is true of Austria, of Switzerland, Belgium and England.

It was as late as 1880 that the result of the expansion of this trade school system on the continent began to be seriously felt in England. They were suddenly and sharply awakened to the fact that France and Germany were competing with them for the foreign trade of the world, and that too, with alarming success, notwithstanding their longer experience and superior machinery. As a result of this awakening, they began to see quite conclusively that foreign designing was more tasteful, the dyeing and finishing more effective, and there was on the whole a something which could hardly be expressed in words that made the foreign goods sell to a better advantage than their own right in England. This state of affairs aroused our English friends to such a degree that Parliament was petitioned to appoint a commission to look into the cause. This was done. The commissioners' instructions were to inquire into the various technical and trade schools on

the continent, with the special view of reporting upon the effect the instruction given in these schools had upon the various countries in which they were situated.

In their final report the committee said, "We strongly recommend the introduction of technical instruction into the elementary schools, and also the formation in all textile districts of evening classes for the instruction of the textile workers in textile design and fabrication." Since then great progress has been made in this direction, and enormous sums have been spent, laws have been enacted, appropriations have been made to carry out the above mentioned suggestions, and while to-day she is not abreast with the chief continental nations, she is making marvellous progress. The two principle textile schools of England are located in Yorkshire; one at Bradford, forming a department of the Bradford Technical School, and the other at Leeds ten miles away, and forming a branch of the famous Yorkshire College. Both of these schools have excellent departments for the instruction of dyeing and chemistry which does not, however, form a part of their course in textile design, but can be so taken if desired.

Briefly stated, these are the methods our European rivals have adopted to not only raise the standard of their productions, but to raise up a body of industrials so they would ever be on the alert to grasp the opportunities as they arise. The highest and best positions of the factory have been filled long ago by the graduates of the technical school, and year by year the graduates of the textile school are absorbed into the "personelle" of the factory, and more and more the departmental outfit is being filled by educated craftsmen, until it is under the sway of men who know the reason for every step taken, and who know full well the necessity of carrying out to the letter every detail of the business.

The need for similar instruction in this country became very apparent to some of our more progressive manufacturers of Philadelphia as far back as 1876, or about the time of the ad-

vent of the then new worsted fabric which was being introduced into this country, and which brought into activity a new element of design and workmanship. They saw that there was a lack of skill to properly handle this branch of the industry; not only the skill in the making of goods alone, but the skill in the bringing out of the design, the dyeing, and in the finishing. They saw quite conclusively that if our textile industries were to prosper or become industrially independent, we must have organized and thorough instruction in all the mysteries of textile fabrication, and to accomplish this they saw that it would be necessary to train the rising generation in a different manner than its predecessor.

To this end the manufacturers formed themselves into an association, to be known as the Philadelphia Textile Association. Its members represented the progressive element of the manufacturing community of Philadelphia and vicinity, men who were alive to the needs of the hour. At that time no thorough school existed in this country, and it was necessary to begin at the foundation of the work, without previous knowledge of the exact methods to be adopted, or the means to be employed to reach the desired end.

It was apparent that considerable money must be raised to properly lay the foundation for a successful school. The sum of fifty thousand dollars was fixed upon as the minimum amount, and the association endeavored to obtain this sum from the manufacturers of Philadelphia by subscription; but as with every charitable enterprise, a few leading men and firms bore the burden of the work. The before-mentioned sum was never reached, and the whole enterprise seemed likely to be abandoned. At this juncture Mr. THEODORE C. SEARCH, then president of the association, despairing of success in the effort to raise the fifty thousand dollars, and being certainly more accurately aroused than others, concluded to assume the responsibility of attempting the work himself without the aid of any subscriptions. This project was made known to the trustees of

the Pennsylvania Museum and School of Industrial Art, and rooms were placed at the disposal of the new school in their school building, which was then located at 1336 Spring Garden Street. Teachers were engaged, and a night class of enthusiastic students organized in 1884-5. The outfit was limited, necessarily so, but was increased as experience showed the needs to be supplied.

At the meeting of the Philadelphia Textile Association, held some time later, the subject was again discussed, and the association decided that it would be wise to sustain the enterprise, and recommended the subscribers to the before-mentioned fund, to turn over the amount of their subscriptions to its use. This was done, and nearly thirty thousand dollars was transferred in this way. It therefore remained for Philadelphia to found in a modest way what is now known as the Philadelphia Textile School, and to Mr. THEODORE C. SEARCH, now President of The National Association of Manufacturers, belongs the proud distinction of being its founder, to whom all honor and credit is due. Indeed he assumed from the very first the entire responsibility of organizing and equipping the textile school, and to his devoted and untiring service in its behalf, from its first inception to its present high state of development, more than all other agencies combined, its success is due.

Philadelphia is no doubt the largest textile centre in the United States; it is estimated that upwards of two hundred thousand people are dependent upon the textile industry for their daily support. Geographically, it lies midway between the two great textile manufacturing sections of this country, the New England States on the north and the Southern States on the south. There is no city in the Union which has a greater diversity of textile manufacturing within its borders, so that no better place in this country could have been selected to give such a project a fair, square and honest trial, and no better place perhaps, could be selected where the two sides of the question could so properly be taken care of, namely, a day school for

pupils who wish to become overseers, superintendents, chief designers, and so forth, and a night school where the operatives actually employed in the mills during the day — loom fixers, weavers, section hands, clerks, dyers, and so forth — take up the study of textile fabrication to elevate their condition.

From the small beginning of 1884, the school has grown by steady additions, slowly but surely, to such proportions that the forty thousand square feet of floor space which it now occupies is hardly adequate to accommodate its needs. In the matter of machinery and other essentials the school has, through the generosity of manufacturers managed to keep pace with the growth of its surroundings. Its equipment comprises over sixty hand and twenty-two power looms, two sets of cards and one mule, one willow, two pickers, and fulling mill, and gig and shear and other machinery for finishing, winding, twisting, card cutting, and so forth. Four well-lighted rooms are set apart for work in color harmony, Jacquard sketching, mechanical drawing, fabric structure, and fabric analysis, as well as for miscellaneous lectures. The work in chemistry and dyeing is carried on in four communicating rooms which contain desks and chemical apparatus, soap kettles, dyeing and scouring vats, hydro-extractors and a dryer. The four weave rooms have a combined floor space of eight thousand square feet, and are filled with the products of the loom builders' art. No other institution in the world can show the variety of up-to-date machinery to be seen at this school. From the light cotton loom with its filling magazine and warp stop motion, to the large and more cumbersome carpet loom, is quite a move, but the interval is well filled with others for silk ribbons, cotton fabrics, worsteds and woolens, dress goods, union fabrics, etc.

Our pupils are not only made familiar with the worsted and woolen, the gingham, the fancy dress goods, the ingrain carpet, the broad upholstery and silk looms of the Knowles and the Crompton makes, but the Furbush, the Thomas Wood, the Ingram, the Northrop, the Schaum & Uhlinger, carpet, cloth, ribbon and silk looms.

Our wool preparing, carding and spinning plant, is quite as complete as regards the equipment, as the power weaving just mentioned. It allows us to begin with the raw materials, cleanse, blend and thoroughly mix our wools preparatory to carding, then card and spin them to the various sizes required. Coupled with the actual practice on these machines, the students are taught the uses and the abuses of the various kinds of card clothing, the relations of one cylinder to another, how to set and time the various parts, the calculations of the speeds, the different rubbing motions, in fact, all the peculiar and necessary information which goes to make up the knowledge of a successful carder, and further, each student through the aid of chemistry, is taught the chemical formation of the fibre itself, and the action of the various alkalis and cleansing materials upon it. What applies to the carding equally applies to the spinning. The result of this is that they have a comprehensive view of manufacturing in general. They are always prepared to meet the demands of the market.

Chemistry of dyeing, and the actual dyeing of yarns and fabrics, forms another branch of the course, which, coupled with the study of color harmony, makes one of the most important departments of our school. I believe it is along the line of skilful dyers and colorists that we are the most lacking in this country, and I am persuaded that the large sales of foreign productions in this country is influenced as much by good, bright and even colors, as by the design and finish. The textile school has therefore made this one of the leading features of its work, and the result has justified the time, labor and money spent in perfecting this department. But while there is much that can be said about the lack of dyers, whose knowledge of the art is based upon chemistry, there is equally as much to be said as to the need of artistically trained designers. The director of the famous textile school of Prussia, Professor LEMCKE, said, when asked as to the form of instruction, that drawing was one of the first requirements of their school. "The pupils must first be

taught to draw thoroughly; teach drawing or art, pure and simple, in the first instance," said he, "without heeding the predilections of the student, because the more the students are grounded in the knowledge of form and color, the more proficiently will they be able to turn their knowledge to useful accounts afterwards."

The groundwork of all design that is worth anything is art, therefore, I am proud to say that I know of no school that is so particularly favored in this direction as the Philadelphia Textile School, and I cannot help but believe that out of the early exigencies of the case the builders constructed better than they knew when they accepted the kind offer of the Pennsylvania Museum and School of Industrial Art. The importance of an art atmosphere, such as we have in the Pennsylvania Museum Schools, to the textile school cannot be too highly estimated. It is of inestimable value to any child to have intelligent and appreciative parents to direct their footsteps and enrich their minds; such a one has a direct advantage over those who are less fortunate. He is taught continually by precept and example, and his constant associations with cultured people unconsciously impresses him, until he grows into his full manhood with a wealth of attainments, and the power of expression that no school can ever hope to furnish. So the association of a textile school with a school of art, gives to its pupils something more than art instruction; it gives that fine taste and culture, that, insensibly as it were, calls forth the highest efforts, and develops the artistic sense to seek expression in the most becoming form and manner.

The curriculum of the school is made as broad as possible, not only are our pupils made familiar with one branch of manufacturing, but many branches. The instruction in fabric structure and analysis, including the necessary and most approved methods of calculation, covers all kinds and styles of fabrics — cotton, woolen, silk and union fabrics, in all their forms and varieties. It is my firm belief, therefore, that herein lies the

success of our school, and I am fully convinced that three years spent in the Philadelphia Textile School is more than equivalent to twice that time in the best mills in this country. I am often asked why we do not encourage our pupils to specialize; it is simply because we believe it is quite soon enough to specialize when they have completed the full course. They have a more comprehensive view of manufacturing, they are more able and prepared to meet such changes in the market as circumstances may demand, more ready, and can appreciate new things more quickly, than one whose attention is continually called to contemplate one style of manufacturing and one only.

Experience has taught us that not one pupil in ten eventually follows the particular line of textile work that he thought he would when he entered the school; indeed, I could mention more than one who have become dyers, whose original idea was to have been designers, it having been found, through the school, to be more congenial to their taste. I am aware of the great influence of design upon the sale of textile materials. I am also aware of the necessity of good dyeing and finishing, but I am equally persuaded that a knowledge and correct use of the raw materials has as much to do with happy results as either of the foregoing. Here again the school is particularly fortunate, for gathered in the classroom and in its valuable museum at Fairmount Park, are specimens of raw materials of cotton, wool and silk from the world over. Its pupils not only have the advantage of these for comparison, but they also have the advantage of all the textile fibres contained in the new Philadelphia Commercial Museum; here is contained a collection of wools, hairs and furs that is not surpassed, if equalled, in both hemispheres; cottons from every clime, also silks and grasses. I cannot speak too highly of such things, for they are of untold value to any textile school, and none is complete without such.

I may perhaps be pardoned for adding to a paper which I am afraid you may regard as already too long, a page or two out of our Philadelphia experience that may possibly fit your

case in Massachusetts too, and aid in answering a few, at least, of the special questions that arise sooner or later whenever a work as new as this is fairly started. I have kept myself sufficiently well informed regarding recent discussions of this subject in your State, and I have already been asked by Massachusetts men so many of the questions to which the little that I have still to say may be regarded as in some sort an answer. I feel a certain amount of confidence in your deep interest in this part of the matter which we have met to consider, and while I am far from feeling that any judgment of mine is to be regarded as final, I shall I trust, be pardoned for opening the subject and for making such modest contributions to its discussion as it is in my power to do.

What I want to say is this: we are met at the threshold of this effort to inaugurate a new movement in education by the following questions: How many and what kind of pupils can we fairly hope to attract to a school limited and devoted to textile education? What kind of preparation will those pupils have had, and on what plane will it be possible to instruct them? Will they be men whose minds are sufficiently well developed already so that it will be possible to give them a technical education that shall be comparable to that which has come to be regarded as requisite in the case of the engineer and the architect? Or is it necessary, and even desirable to count on a class of pupils whose early lives, for the most part have been spent in actual work in the mills; whose general education in the literary and scientific branches at least has been so rudimentary in its character as to render the attainment of most of that which belongs to the higher culture, so called, particularly out of the question in their case, while on the other hand they may fairly be expected to grasp more readily, and to apply more directly those principles which are only to be learned, not from books, and in theory, but by actual processes, such as are to be obtained only by work in a mill. Now while it is probably quite as important to reach one of these classes as the other, it must

not be forgotten that the difference between them is by no means to be overlooked, and the attempt to provide the kind of instruction that would be required by either one of them, for pupils draw mainly from the other, could only lead to much disappointment and loss.

Our experience in Philadelphia is that the pupil who comes from the operative class or whose mind for any other reason (and there are several that are all sufficient) inclines mainly toward questions of actual manipulation of material and the running of machinery, cannot be expected to go very deeply into matters that pertain to either the science or the art of textile manufacture.

In the first place he can only come to the school in the evening, and if we can count on his attending two hours three nights a week from October to April, it is as much as we can ever expect. This means that he devotes during an entire school year one hundred and fifty-six hours to the work of the school, which is only equal to about twenty-two days in the day class where our pupils work seven hours a day. Moreover, such pupils are apt to be not only exceeding impatient of efforts to make their instruction include the more fundamental branches, such as chemistry, mathematics, and drawing, but for the vast majority of them it is practically impossible owing to the limited prepation which they have received, for them to acquire more than a general and elementary knowledge of these subjects; on the other hand they eagerly seek, and readily grasp instruction in practical questions of the adjustment and use of machinery, and develop a degree of skill in the processes of actual production, that is hardly ever attained by the pupils whose early studies have been of a less practical kind.

The PRESIDENT. There is on the statute books of Massachusetts a law that is very favorable to the formation of textile schools, and this law has been declared constitutional. It is

very much through the efforts of the author of the next paper that this law has been put on the statute books; he worked in the Legislature and out of it toward that end, and I take pleasure in presenting to you Hon. FRANK P. BENNETT.

PUBLIC TEXTILE EDUCATION IN MASSACHUSETTS.

MR. FRANK P. BENNETT, Boston, Mass.

When the President of your Association first asked me to contribute to this discussion, the legal aspects of the question of State aid to textile schools was mentioned as the particular topic to which I should turn my attention. But all legal obstacles to the establishment of one or more textile schools in Massachusetts under the statute of 1895, having been removed by the recent decision of the supreme court, I shall take the liberty of departing somewhat from the precise limits of the topic assigned me.

One of the arguments in favor of textile schools is the same as for medical, theological and law schools, viz., that far better work is done in a school in the midst of a contagious enthusiasm than as a solitary student, whether in an office, a mill or a family. Doubtless a good physician was often made in earlier times of the apprentice who accompanied the doctor upon his round of calls; a successful lawyer was similarly graduated from an attorney's office; and a good clergyman was trained as a solitary student in the family of a minister. Likewise one of our own boys, with a firm purpose, settled habits of application and a good tutor, might obtain an excellent academic education in his own home without ever entering school, college or academy. But very few of us consider it wise to attempt to educate our boys in that way. The companionship and intellectual excitement of the school, the opportunity which the boy has of meas-

uring his capacity with that of his fellows, the generous emulation and the sympathetic atmosphere of kindred studies and interests are worth so much, that few of us care to deprive our children of such advantages of school and college as we feel that we can afford.

THE ACT OF 1895.

The act of 1895, chapter 465, provided that in any city of Massachusetts, whose mayor should, "on or before the first day of July, in the year 1895, file a certificate with the commissioner of corporations that said city had in operation 450,000 or more spindles," a corporation might be organized for the purpose of establishing and maintaining a textile school. Such corporation may hold personal and real estate to the amount of $300,000, and it was further provided that the city in which the school is located may grant city aid to the enterprise to the amount of $25,000, and that the Commonwealth may then furnish State assistance to the amount of $25,000.

Under this act the Massachusetts cities whose mayors filed certificates with the commissioner of corporations on or before July 1, 1895, as provided by the statute, were Lowell, Lawrence, Fall River and New Bedford. So that, as far as the act of 1895 is concerned, the powers granted by the Commonwealth under that statute are confined to the four cities named. The city of Lowell began to take advantage of the act with commendable promptness, but when a loan of $25,000 had been authorized in aid of the school, the bankers to whom the bonds were to be sold, were advised by their attorneys that the securities were not good, because the act of Legislature authorizing them was unconstitutional. It was declared to be a violation of Article XVIII of the constitution of Massachusetts, which provides that "all moneys raised by taxation in the towns and cities for the support of public schools, shall be applied to and expended in no other schools than those which are considered, according to law, under the order and superintendence of the authorities of the town or city in which the money is to be expended."

WHY IT WAS THOUGHT UNCONSTITUTIONAL.

It should be borne in mind that the act of 1895 provides for a corporation of not less than seven nor more than twenty persons, to be "known as the trustees of the textile school," and while these trustees must be citizens of Massachusetts, they need not be residents of the city in which the school is located; and after the city aid is granted, only the mayor and superintendent of schools are added to the corporation to represent the city.

The attorneys who thought the act unconstitutional, not only considered it an infringement of Article XVIII of the constitution, but also doubted whether the maintenance of a textile school was such a public purpose that the public money could be properly applied to it. They cited the well-known case in which WM. JENKINS, in 1869, united with other inhabitants of the town of Andover, and secured a decision of the supreme court, invalidating a vote of an Andover town meeting, "that the town aid the trustees of the Punchard Free School in rebuilding their schoolhouse recently destroyed by fire, to an amount not exceeding twenty-five thousand dollars." The vote was declared invalid because the school was not "under the order and superintendence of the authorities of the town."

IT WAS DECLARED CONSTITUTIONAL.

But when the textile school act of 1895 was referred to the supreme court upon a friendly suit brought for the purpose, it was declared constitutional. The precedent cited in this instance was that of the Agricultural College at Amherst, in which case the short and decisive answer was made that the eighteenth amendment to the constitution of Massachusetts applied to "common schools" and "public schools," which phrases have acquired under the legislation and practice of this State a well-settled significance. They are never applied to those higher seminaries of learning, such as incorporated academies and col-

leges. To this class of institutions the Agricultural College at Amherst and the textile schools, authorized by the act of 1895, clearly belong. Moreover, the court calls attention to the fact that the textile school act of 1895 is in aid of manufactures, and therefore falls within the provisions of section 2 of chapter V of the constitution of Massachusetts, which provides, among other things, that "it shall be the duty of legislators and magistrates, in all future periods of this Commonwealth, to cherish the interests of literature and the sciences, and all seminaries of them, to encourage private societies and public institutions, rewards and immunities, for the promotion of agriculture, arts, sciences, commerce, trades, manufactures, and a natural history of the country."

GENEROUS STATE AID TO THE FARMERS.

The constitutionality of State aid to textile schools in Massachusetts, under the law of 1895, being thus fully affirmed, it is to be hoped only a beginning has been made in the appropriations authorized by that law. The Agricultural College has received from the Commonwealth in State aid from its inception up to the present time the munificent sum of $1,169,706.88. Up to and including 1894, the amount paid to the Agricultural College, including the income of what are denominated the technical educational funds, was $818,254.90. The amount paid the Agricultural College for scholarships for the same time, $120,000. The amount paid the Agricultural Experiment Station for the same time, $139,250.

The amount paid the Agricultural College for 1895 was: for buildings, $10,119.82; grant, $10,000; income of the funds, $11,082.16; scholarships, $10,000; experiment station, $10,000.

For 1896, the appropriation for what they call "the grant" was $10,000; scholarships, $10,000; experiment station, $10,000, and the income from the funds for 1896 will probably be about the same as for 1895, that is, $11,000. Up to the present moment there has been no appropriation for buildings this year.

Assuming that the 1896 expenses will be the same as 1895, we have a grand total of:

Agricultural College, including income,	$870,456.88
For scholarships,	140,000.00
Experiment station,	159,250.00
	$1,169,706.88

BUT THIS IS A MANUFACTURING STATE.

And yet this is not an agricultural but a manufacturing State. Our principal agricultural interests — those of market gardening and dairying — depend for their success upon the prosperity of our manufactures. The future of Massachusetts is very largely dependent upon its textile industries, and the State appropriations for textile education hereafter may very well keep pace with those for agricultural experiments and training.

The textile schools of the future will take the place of the apprenticeship system of the past, to which England and continental Europe owe so much of their industrial supremacy.

While the textile schools authorized in Lowell, Lawrence, Fall River and New Bedford, are legally classed with the higher institutions of learning, yet in the plan which I am going to take the liberty of outlining in this paper, for the promotion of textile education in Massachusetts, I will class the proposed schools in the four cities named, rather as intermediate institutions. Below them might be some rudimentary forms of textile training in the public schools, and above them should be a college of textile science, preferably in connection with the Massachusetts Institute of Technology.

THE PUBLIC SCHOOLS.

As to textile training in the public schools, it should be remembered that an act passed in 1894 provided that "after the first of September in the year 1895, every city of 20,000 or more inhabitants shall maintain as part of its high school system,

the teaching of manual training. The course to be pursued in said instruction shall be subject to the approval of the State Board of Education." Under this act it would be as proper to introduce a loom or a spinning frame among the school apparatus as a lathe or a jig saw.

The introduction of manual training in the public schools of Massachusetts may be said to have begun with the introduction of drawing as a required study by the act of May 16, 1870. In the next annual report of the State Board of Education, it was suggested that "the State authorize all cities and towns having a population of 5,000 and over, to establish free technical schools for instruction in such branches of knowledge, common to the leading industries of the entire State as may, from time to time, be prescribed by the Board of Education." March 9, 1872, the Legislature passed the permissive act authorizing cities and towns to establish industrial schools, and in this very brief allusion which I shall make to the progress of industrial education in Massachusetts, I desire merely to emphasize the fact that in these twenty-four years since the passage of the permissive bill of 1872, the work of the carpenter, the blacksmith and the machinist have become increasingly familiar in connection with school work, but

NO MULES OR LOOMS

have yet been included among school apparatus, and so far as we are informed even an analysis of the structure of the cloth whose manifold uses distinguish the civilized man from the savage, is not taught in any of the public schools of Massachusetts. Of course the principal object of industrial training in the lower grades of our public schools is not to graduate experts in any one branch of the mechanic arts, but rather to elevate manual labor; to overcome the theory in the minds of some young persons that what is called "work" is performed only by physical force, and to cultivate artistic taste and mechanical skill in general. But we find that among the towns

and cities of Massachusetts, having less than 20,000 inhabitants, twenty-one are teaching wood working and carpentry for boys and sewing for girls, combined in some instances with cooking for the female pupils and metal working for the boys. The act of 1894, to which I have already alluded, as providing for manual training in the high schools of cities having more than 20,000 inhabitants will affect twenty-three cities.

It seems to me quite important that such representations should be immediately made to the Board of Education as will lead to the introduction of as great a degree of textile education as is practicable in the manual training departments of the high schools under this law. To this end, this New England Cotton Manufacturers' Association ought to select an educational committee of three members, who should be consulted as

AN ADVISORY COMMITTEE

by the Board of Education. A meeting of school superintendents and others was held at the State House in March, 1895, at the invitation of Secretary HILL of the Board of Education, to consider a plan for meeting the requirements of the act of 1894, relative to manual training in cities of 20,000 or more inhabitants. This committee recommended the following course of instruction in manual training:

1. That the shop exercises of the first year be confined to woodwork with hand tools only.

2. That the work of the second year be so arranged that one-half of it shall consist of wood turning and pattern making, and the other half, either (1) forging or (2) chipping, filing and iron fitting.

3. That the time devoted to drawing be not more than one-half of that given to shop work, and that the total number of hours per week for manual work, exclusive of drawing, be not greater than ten nor less than six.

4. That the manual instruction for the third and fourth years be in machine shop practice.

PUT ON SOME TEXTILE MANUFACTURERS.

With one or two textile manufacturers upon such a committee as that above mentioned, could not some instruction in the dissection of patterns of cloth, the building of the chain for a fancy loom, the weaving of patterns upon a pattern loom, or taking apart and putting together a loom or a mule, have been introduced as a feature of this course in textile education? Boys' tastes and selections of a permanent avocation in life are often influenced by minor occurrences. A picture over the mantle of the old farmhouse, of a ship proudly sailing over a more or less realistic sea, has been known to be the basis of transformation of a farmer's boy into a captain in the days when the sailing of foreign voyages was a more necessary part of the business of the world than to-day.

There are two schools in Massachusetts which are said to pre-eminently exemplify the sort of training which the act of 1894 contemplates. I refer to the Mechanic Arts High School in Boston, and the Cambridge Manual Training School for boys in Cambridge. The latter institution has continued thus far from the beginning as the munificent private benefaction of a former resident of that city.

THE BOSTON MECHANIC ARTS SCHOOL.

The Mechanic Arts High School in Boston is located at the corner of Belvidere and Dalton streets, in the Back Bay district. The building, 224 feet long by 90 feet wide, three stories in height, of brick and brown stone, was erected in 1892-93 at a cost of about $165,000. The cost of land, furnishings and special equipment soon to be added will increase that amount to about $230,000.

On the basement floor are the boiler room, sanitary arrangements, engine room, dressing rooms and the forge shop.

The first floor has two schoolrooms, accommodating several pupils each, a physical laboratory, machine shop, tool room, and a room for the circular, band and jig saws.

On the third floor are the lecture room, rooms for mechanical and free-hand drawing, a storeroom for tools and drawings, and the lumber room. A wing, designed to contain the principal's office, the library, the reception room, and the chemical and physical laboratories has not yet been erected, nor has the moulding and casting shop on the ground floor next the forge shop.

BEST EQUIPMENT IN THE UNITED STATES.

The equipment of each department is equal to the best to be found in the country. The wood working room contains 36 double benches for carpentry, furnished with complete sets of excellent hand tools.

In the wood turning and pattern-making shop are 36 benches equipped with the Putnam Machine Company's 11-inch swing speed lathes upon one side, and upon the other with Wyman & Gordon quick-action vises, and complete sets of tools of the best quality.

UNIQUE ACCOMMODATIONS.

The drawing rooms have accommodations for six classes of 36 each. The drawing tables are unique. Each is fitted with a locker holding six half-imperial drawing boards above which is a common drawer for inks, drawing instruments, curves, scales and various other tools used by all the boys. At the right are six individual locked drawers for pencils, erasers, note-books, etc., the personal property of each boy.

Besides the usual keyboards, cases, blackboard stands, etc., this department has, in all probability, the best blue-printing apparatus now in use. The printing frame, which will take two imperial sheets, is mounted on an adjustable rolling car of special design. Special sinks of soapstone afford facilities for evenly rinsing, washing and drying the prints without the slightest inconvenience. Running nearly around the sides of the machine shop are benches of graduated heights equipped with 24 four-

inch vises and as many sets of tools for chipping and filing. The room is furnished with 24 engine lathes and with hand lathes, an automatic planer, a universal milling machine and other expensive special machines to acquaint the boys with the latest and best methods of iron finishing.

In the forge shop are accommodations for three classes per day of 24 each. There are three Buffalo four-fire forges, and six of a two-fire pattern. This room also has a special forge, fitted with a hand blower, for the instructor's use, emery wheels run by power, a hand drill and a bolt-heading machine of the latest pattern. Fans of ample size carry away the foul air and products of combustion, thus securing perfect ventilation.

A THOROUGHLY CAPABLE INSTRUCTOR.

The aim of the school, says the forthcoming report of the State Board of Education, from which I have secured most of the above facts, is to give its pupils the equivalent of a first-class English high school education, a training which fits a boy, not for a specific trade, but to take up any trade or profession with a wider view, a more facile power, a broader culture. Or, to quote Dr. PARMENTER'S own words: "The school will aim to encourage every noble endeavor, foster every worthy ambition, insist upon high standards of attainment in study and of perfection in mechanical work, cultivate self-control, kindness, politeness and manliness, and deepen respect for honest toil. It already gives encouraging assurance that it will justify the expenditure made in its behalf by doing its full share of the work of transmuting into noble character the diverse elements that our complex civilization pours into the public schools."

I have entered into this description of the Boston Mechanic Arts School somewhat more fully perhaps than my subject warrants, because I was anxious to indicate how much is beginning to be done in general technical education while the special field of textiles is still neglected.

The Boston Mechanic Arts School was opened in 1893, Sep-

tember 6th, under the head mastership of FRANK A. HILL. From May 1, 1894, to the end of June, it was without a principal, Mr. HILL having resigned to become secretary of the State Board of Education. Dr. PARMENTER then entered upon his duties.

THE INSTITUTE OF TECHNOLOGY.

Cannot Lowell, Lawrence, Fall River or New Bedford, with assistance from the State, and possibly from manufacturers, accomplish in the establishment of a textile school all that has been done in Boston for the Mechanic Arts School. I have referred to these proposed textile schools, authorized by the act of 1895, as intermediate institutions. In discussing the subject of textile education, when it was suggested that the work should be undertaken by the Massachusetts Institute of Technology, President WALKER of that institution said:

"If the proposed textile school is to be a school of textile science, we should be heartily glad to take it up and carry it on with all our best thought and effort, upon condition of the Legislature making a reasonable provision therefor. . . . . It is not an exaggeration to say that we have two-thirds of all which the proposed new school would need. . . . . I have before me as I write the schedule of a four years' course in textile science prepared three years ago by Professor SCHWAMB at my request. . . . . If, however, what the Legislature has in view is merely a school to teach boys how to weave, we should prefer to have nothing to do with it."

A COLLEGE OF TEXTILE SCIENCE.

It has been semi-authoritatively estimated that such a college of textile science as indicated by President WALKER, could be established in connection with the Massachusetts Institute of Technology for $75,000. The four years' course would be identical in many of its parts with existing courses of study in the Institute; the present teaching force, laboratories and me-

chanical equipment would be partially available, and the graduates of such a college of textile science would be given as broad and thorough a training for mill work, and would begin practical work in textile manufactories with the same advantages as are now possessed by the graduates in mechanical and civil engineering and other departments of the Institute when entering upon their chosen profession. I would suggest that an appropriation of $75,000 be asked from the next Massachusetts Legislature for the establishment of a college of textile science in connection with the Institute of Technology, and that a committee of this Association be appointed to urge such an appropriation.

INTERMEDIATE TEXTILE SCHOOLS.

Before considering the relations of the Institute of Technology to this matter, and the eminent fitness of that institution to successfully incorporate with its other departments that of a school of textile science, I would refer briefly to the need which exists of one or more textile schools in which pupils of moderate means can take short or partial courses in branches of the textile industry, and in which the advantages of evening classes can be accorded to those whose occupations will not allow them to attend the school during the day. As there must be academies and schools for those who cannot afford a college training, but who would like to obtain as much education as their means will permit, so there should be opportunities afforded for textile students who are not able to devote the necessary four years to study in an advanced school of textile science. Yarn calculations, cloth analysis, study of the principles of the structure of fabrics, the use of a hand loom in pattern weaving, and dismantling and reconstructing a power loom might be combined with lectures in chemistry and the study of mathematics. In the Philadelphia Textile School a considerable proportion of the students come for the designing alone, and nearly as large a proportion drop out before reaching the third year.

Mr. FRANCE. I would like to correct that statement a little. That was the case in its early history, but that is not so to-day. The most of the students take their full course. I will admit this, however, that there has been quite a demand at the end of the second year, and we have not had the full graduates to the number that we ought to have, for the simple reason that places were found for them; but they do take their chemical and dye sheet and calculation courses right through, and attend specials.

Mr. BENNETT. I am very glad of the correction of Mr. FRANCE, with relation to the students dropping out; but the other, as to the demand for them, I have referred to later on in this paper.

I am not defending their failure to complete the full course, but am merely calling attention to the facts as they exist. The faculty of the Massachusetts Institute of Technology are understood to be willing to undertake a certain amount of supervision of these subordinate textile schools, and to furnish instructors, lecturers, etc., not only for evening but for day work.

WHERE TO BEGIN.

In the suggestions for the promotion of textile education in Massachusetts which I have thus briefly outlined, viz.: (1) Rudimentary textile training in our public schools under the present laws providing for technical education in the public schools of Massachusetts; (2) special textile education in such schools as have been authortzed in Lowell, Lawrence, Fall River and New Bedford; (3) a broad and advanced college of textile science, either in connection with the Massachusetts Institute of Technology, or growing out of the schools at New Bedford and Lowell or other textile centres — in these brief suggestions of course the proposed schools at Lowell and New Bedford merit the most attention because they are actually about to make a beginning in textile education. In Lowell the $25,000 of bonds issued by the city for the purpose have been sold; the addi-

tional $25,000 has been obtained from the State; and with $50,000 in hand, the trustees of the Lowell Textile School are ready to begin work. They will probably find that the quickest and most practicable method of initiating their undertaking will be through evening classes or lectures; but the precise method of beginning the work is not so important as that a beginning should be made. The situation is not unlike that traditional occurrence in war when the general of brigade asks his corps commander: "Where shall I strike in?" and the answer is: "O! begin anywhere. There's elegant fighting all along the line." If the trustees of the textile school in Lowell merely hire a room and engage various gentlemen to give free lectures upon thc structure of cloth, character and comparisons of fibres, etc., that is the beginning of a textile school.

WHO WOULD BE THE PUPILS?

There are in the city of Lowell 237 loom fixers, section hands and third hands, of whom 196 are in cotton mills and 41 in woolen mills. There are also 200 overseers and as many second hands. Some ambitious young men are also included among the common weavers. From these loom fixers, overseers and others, might be obtained the first nucleus of the school. Some years ago I attended many of the meetings of a Lowell Overseers' Association which had a very considerable number of members for a time, and which met once a week and discussed such subjects as:

1. Baling, compressing and handling cotton.
2. Temperature and humidity, atmospheric changes, loss and gain in cotton fibres.
3. All essential points of card clothing — steel wire, foundation, system of grinding, production, etc.
4. The uses of the railway head.
5. Discussion of licker-in and shell feed systems.
6. Power and twist on spinning frames (this subject was elaborately treated, several papers having been read).

7. Methods of sizing cotton warps; Mr. BROOKS of the Boott, read an excellent paper.

8. Weaving in all its phases (16 papers were read).

9. Transmission of power by ropes — cotton or manilla.

10. Division of labor— distribution of work in mill; question of the number of overseers, etc.

11. Methods of ventilation.

12. Practicability or otherwise of the half holiday (Saturday).

Mr. F. E. SAUNDERS, at that time and I believe yet an overseer of carding on the Hamilton corporation in Lowell, was the very efficient president of this

LOWELL OVERSEERS' ASSOCIATION

and perhaps it was due to experience gained in the discussions there that he was able to present a very excellent paper before this association in 1890, on the effect upon cotton fibres of changes in temperature and humidity in mills, with interesting tables of statistics, etc. The textile school might make a beginning merely as a large gathering of overseers, second-hands and loom fixers, meeting once or twice a week, with topical discussions led by manufacturers or others familiar with technical questions. A class of beginners in easy lessons in cloth designing might follow, to be succeeded in turn by studies of the mule, loom, card or other preparatory machinery. The *American Wool and Cotton Reporter* has in its Boston office a department called an "Overseers' Bureau," devoted to providing men with situations as overseers, loom fixers, superintendents, designers and other positions of responsibility in mills. Upon the books of this bureau are or have been the names of 6,344 men, of whom not more than one-third are of American birth. More than one-half are Englishmen, and the balance are Irishmen, Germans, Poles, Austrians and various other nationalities. Even of the English dyers and designers very many do their work merely by what may be called

and the best of them are of course those who are able to do something more than to follow in the beaten path of picking out and reproducing foreign designs. One reason why so small a percentage of the students in the Philadelphia Textile School remain after the first or second year is because there is a demand for their services which tempts them to leave without completing the full course of the school.

I was very much impressed by the remark which I once heard made by a leading American worsted manufacturer of English birth, at a meeting somewhat similar to this, that even when England was in the throes of the Napoleonic wars, when the honor and existence of the nation were at stake, and when men were being impressed in great numbers to fill the requirements of the British navy, the young man who was seized and carried aboard one of his majesty's ships, but who had the indentures of an apprentice in his pocket, was promptly released and put ashore. Although England had a Napoleon to cope with, the indentures of an apprentice were more sacred than enlistment in the navy. The technical schools are the modern substitute for the

APPRENTICESHIP SYSTEM

in England, and in a recent address by an English worsted manufacturer, and a member of the British Royal Commission on Technical Education, before the Accrington Technical School in Lancashire, the lecturer ascribed the depression in English agriculture to the lack of technical education. He said: "Our imports of butter, eggs and cheese amount to over £24,000,000 annually, and a recent report on the high quality of Danish butter applies also to other agricultural products, that 'success is the outcome of some 30 years' persistent pegging away at techical education.' 'Sound technical education is at the bottom of it all.' And so again," continued the English worsted manufacturer, "while we have neglected technical instruction at home,

we are in many instances paying in agricultural imports for the technical instruction of our rivals abroad, and tens of thousands of acres in this country are going out of cultivation." What this expert upon the subject of technical education in the British textile industries had to say about the lack of technical instruction in English agriculture, applies to the lack of technical education in the textile industries in America. We are paying in textile imports for the technical instruction of *our* rivals abroad.

IMPORTANCE OF THE TEXTILE INDUSTRIES.

A brief reference to the importance of the textile industries of Massachusetts is almost superfluous in a meeting of this kind, and in this brief and inadequate statement of the necessity of textile education in Massachusetts, I am afraid I have touched upon many matters concerning which the members of this Association were already better informed than I, but my situation has been somewhat like that of the attorney, who was expounding the rudiments of the law at considerable length before a distinguished supreme court judge. His Honor finally interupted, and said with considerable asperity: "You must assume that the court has some knowledge of the law." To which the attorney replied, "That was just the blunder that I made in the lower court, and I do not propose to commit the same mistake a second time." The latest figures I have at hand of the number of cotton spindles in the United States are those for the beginning of the year 1895, when, of a total of 17,126,418 cotton spindles in the United States, 7,160,480 or 42 per cent. were in Massachusetts. Of 8,111 woolen cards in the United States at the same time, 1,811 or 22 per cent were in Massachusetts, and of 1,148 worsted combs, 319 or 27 per cent. were in Massachusetts.

STATUS OF NEW ENGLAND.

New England contains 73½ per cent. of the cotton spindles, 49 per cent. of the wool cards, and 52½ per cent. of the worsted combs of the United States. Much has lately been

said about the action of one of the great Lowell corporations in selling its cloth plant because its largest product consisted of LL sheetings, weighing four yards to the pound, of which weight of goods southern mills have become such large makers that this northern corporation saw no hope of being able to further compete with them at a profit. But many other corporations were confronted with a similar problem, and have changed the character and quality of their output. While there were 7,160,000 spindles in Massachusetts at the beginning of 1895, there was no state south of Mason & Dixon's line which had 1,000,000 spindles. North Carolina had 656,000 spindles, South Carolina, 626,000, and Georgia, 550,000. Of course there have been considerable additions to the number of spindles in the southern states during the past year, and we welcome them as enhancements of American industry, and as bringing our southern compatriots into closer relations with, and a clearer understanding of, the manufacturing interests which comprise so large a proportion of the life and prosperity of our northern communities. No protective tariff can intervene between us and the southern states; but there are some leaves which *New* England may properly cull from the books of *Old* England. The latter has always been

A THREATENED NATION,

and the great depression in British manufacturing industries a quarter of a century ago, following the Franco German war, when many factories were closed, employers ruined and thousands of operatives thrown out of work,—has been equalled both before and since. Macaulay tells us that in 1680—more than 200 years ago—the wages paid in England made competition with Indian looms impossible, and that the cry of labor aginst capital was far more bitter than now. Again, at the beginning of the present century, England had been drained by terrible wars and was steeped in poverty and debt; but the inventions of Arkwright, Hargraves, Crompton, Cartwright and

others in spinning and weaving machinery, and of Watt in steam engines, whereby the factory system was created, laid the foundations of the industrial wealth of England and of the world.

I want to call your attention here to a geographical transposition of industrial centres in England a hundred years ago which may contain some suggestions for those who are frightened by the growth of cotton manufacturing in the Southern States. Norwich, at the beginning of the present century, was the centre of the British wool industry, and one of the wealthiest cities in the United Kingdom, and the all-powerful hand workers made it clear that it would be death to anyone introducing the Lancashire machinery. Lancashire and Yorkshire themselves were often ablaze with the mills that were fired by despairing hand workers early in the century; but while the Norwich workers successfully resisted the introduction of machinery, the Yorkshire and Lancashire manufacturers persevered with dogged Anglo-Saxon stubborness until the worsted trade went to Yorkshire and the cotton trade to Lancashire, while Norwich

WENT DOWN IN THE STRUGGLE.

The same spirit of progressiveness and perseverance which has been effective in Old England, will be equally successful in New England.

The English worsted manufacturer, Mr. SWIRE SMITH, to whose address before the technical school at Accrington I have already alluded, thus speaks of the condition of affairs in England a few years ago which led to the appointment of the British Royal Commission on technical education of which he was a member: "Many factories were closed, employers were ruined, and thousands of operatives were thrown out of work. Our exports seriously declined, but what was almost more alarming, our imports of manufactures greatly increased, and it was said that our trade was permanently leaving us. The alleged causes were many and diverse, and included the so-called advantages of long hours and low wages on the part of our rivals. . . . . There were

not a few, however, who were of opinion that we were behind our rivals in the education of our people, and in the application of science and art to our industries.

A ROYAL COMMISSION.

"In the midst of conflicting evidence, a royal commission was appointed to examine the facts as to the conditions of the people and other matters affecting production and competition in other countries, and to compare their great factories, workshops and schools with the competing establishments in England. The commission consisted of seven representatives of our leading industries, such as iron, cotton, wool, pottery, chemicals, and educational organizations, and it was my privilege to be invited to represent wool," says Mr. SMITH. "Our inquiry was very extensive, as you will discover from the five large volumes of the report which we presented to Parliament.

"But what did we find? That in educational provision and efficiency we were undoubtedly behind some of our continental neighbors, as we were also in some important specialties of trade. But in the great staple industries, and in the general condition of our people engaged in manufacturing pursuits, we still 'held the field' against all rivals.

"It was quite clear, however, that we could not afford to abate one jot in the struggle for cheapness in which every nation on the one hand, by the use of our machinery, was contending against us — barricading at the same time our manufacturers from their markets — whilst on the other hand we should be driven to compete more and more with the most advanced nations in the quality and attractiveness of the products supplied to our own people, and to the wealthier central markets of the world.

"In the opinion of the commissioners the struggle for a livelihood in which we are engaged against all competitors could only be successfully overcome by energy, and the effective mixing of our brains with our work. I need not go over the

report, nor need I enlarge upon the legislation, nor upon the enormous educational progress of the last few years, which is changing the face of our country, and which I am glad to find is bearing such good fruit in Accrington.

A GOOD MUNICIPAL INVESTMENT.

"An opinion is held among the best informed of the educationalists and manufacturers of the continent that their technical schools, which have been so lavishly supported by public funds, are really maintained by the English people, inasmuch as we are the leading buyers of the product of their schools, both in the superior goods which we import and in giving employment to the designers and scientists that the schools have produced. Your technical school, therefore, on financial grounds, is the best paying of all your municipal investments."

At the thirtieth anniversary of the National Association of Wool Manufacturers at the Parker House, Boston, January 10, 1895, Mr. THEODORE C. SEARCH, of Philadelphia, read a valuable paper upon "Textile Education in America," in the course of which he said:

"In glancing over the textile imports, not of the past year of panics and of failures, but of its predecessors, I am confronted with the fact that we are importers of upwards of $100,000,000 worth of goods, manufactured wholly of wool, cotton or silk; and this, too, in spite of the McKinley tariff, which we are accustomed to regard as reflecting the high-water mark of protection to American industries. We built a tariff wall higher than even prince or potentate ever built it, and yet, as I say, in one year $100,000,000 of foreign textiles climbed up its sides and spread themselves all over our country. These industrial invaders marched boldly into our shops, and vanquished our home product. Our manufacturers stood aghast. In the face of an almost prohibitive tariff, our own people demanded foreign goods and paid for them — $100,000,000 worth in a year. If anything was needed to prove the futility of a tariff unaided and

standing alone, to make a great people industrially independent, it was our experience with some recent tariff legislation. We cannot hope to pit successfully against the artistically designed and exquisitely finished fabrics of our foreign competitors only a 40 per cent. tariff. It is an unequal contest.

SUPERIOR GOODS IMPORTED.

"The query naturally arises, What kind of goods are represented by this $100,000,000 of imports? The question can, I think, be truthfully answered by saying that they are of the higher order of manufactures, and represent the net result of the industrial power which comes from technical education. I will not deny that many notable examples could be presented to me of a foreign competition of such a character as not to be classed under this description. Yet the convincing fact remains that in the imports of wool, cotton and silk goods, we are continually receiving the very best expression of modern thought as developed by the technical schools of France, Germany and England.

"My contention is that there is only one really successful method to employ to meet this sort of competition. We must have that protection which springs from the cultivation of our powers, and which leads to happy and elegant expression of our thought in line and color. Such protection as comes from the production of artistic results, and by sheer force of their winsomeness enlists the attention of our people, is worth more to the American manufacturer than even the specific duty which has been shorn of its effectiveness by the last noble effort to encourage our industries.

THE BURNING QUESTION OF THE DAY.

"I am here to-night to make a plea for technical education in the manufacture of textiles. I believe that the question of industrial education is the burning question of the day. The example of Europe and the experience of all the other com-

munities carries with it a lesson which cannot be longer ignored by us. It has long been recognized by every country, whose example is worth anything to us, that industrial education is quite as legitimate and quite as necessary a function of government as maintaining armies or building battleships. Technical schools, in which a lad may learn the use of the special tools characteristic of the trade or business he may choose as his life work, abound in France, Germany, Belgium, Switzerland and England.

"America can no longer ignore the significant lesson which these examples teach. No amount of tariff legislation, important as it is, can possible preserve our home markets to our manufacturers unless they make the quality of the things produced equal, if not superior, to that of their foreign competitors."

I will conclude with the question, "What should the New England Cotton Manufacturers' Association do for the promotion of textile education in Massachusetts?" It should immediately appoint committees upon this subject, which should be committees for action as well as inquiry. Having done this, the members of this Association should further constitute themselves a committee of the whole to encourage textile education in our State without any trammels of geographical prejudice. If Lowell and New Bedford have made a beginning, and other textile centres have not, let Lowell and New Bedford be encouraged and assisted.

PETITION THE LEGISLATURE.

Let a petition be also presented to the next Legislature for an appropriation for a college of textile science in connection with the Massachusetts Institute of Technology. And I would furthermore suggest that a committee be appointed to promote such introduction of the rudiments of textile education in our public schools as may be agreed upon, after conference with the secretary of the Massachusetts Board of Education. I have had the rashness, therefore, to suggest the appointment of three

committees by this Association, viz.: 1. A committee to promote the establishment of a college of textile science, with State aid, in connection with the Massachusetts Institute of Technology. 2. A committee to aid in every possible way the intermediate textile schools proposed in Lowell, New Bedford, Fall River and Lawrence. 3. A committee to act with the secretary of the Board of Education in introducing some measure of rudimentary textile training in the public schools of this State.

Of course these three committees might be combined in one, but I think you may secure better results by the appointment of three separate committees, and much credit will be derived by this Association if it will do such effective work in behalf of textile education at this critical period that it cannot be said a year hence that my too-lengthy paper might more properly have been patterned after the celebrated Hibernian essay upon reptiles in the Emerald Isle. The subject was "Snakes in Ireland," and the essay itself consisted merely of the statement, "There are no snakes in Ireland." Likewise I might have confined my paper upon "Textile education in Public Schools and Special Institutions in Massachusetts," to the explanation "There is no textile education either in public schools or special institutions in Massachusetts."

But while this is true to-day, we hope and believe it will not be true two years hence.

The PRESIDENT. The next subject is topical question number two, "What benefit will the people of the State of Massachusetts derive by the establishment of textile schools?" and I will call upon Mr. N. B. KERR of New Bedford.

Mr. NATHANIEL B. KERR. The question, "What benefit will the State of Massachusetts derive from the establishment of textile schools?" is a broad one and can hardly be answered

off-hand or in a single address. But I think it is safe to say that whatever benefit, whatever good has been realized by other countries that have tried the experiment of technical education for the working classes, the same benefit and the same good will be derived by the State of Massachusetts should we conclude to establish the same system of education here.

Perhaps the first consideration of the question is to determine whether or no there is any necessity for this sort of thing, and why the necessity exists. It certainly has arrived at such a point that in some of the European countries it is recognized as one of the leading questions of the day.

Germany, for some years past, has been active in promoting these schools, and the apparent results have been such that manufacturers, who usually are not inclined to spend money unless they can see their way clear to get it back again, have gone so far as to erect and endow schools in their own neighborhood for the benefit of their own operatives. The result has been that manufacturers of Germany who had paid particular attention to these matters and had taken the trouble and gone to the expense of improving the mental faculties of their work people, came to the front in the quality of their work and also in cost of production.

The competition between England and Germany became so keen and was so manifestly detrimental to England's interests, that an inquiry was set afoot by the English government, and a committee appointed to examine into the matter and report. The result of this inquiry was that the committee reported in favor of some scheme of instruction such as had been adopted by other countries on the continent, and then the English manufacturers began to give it serious consideration. We have only to go back to our grandparents' time to find the custom prevailing of binding apprentices for a term of seven years at both weaving and spinning, and until within a few years it was considered necessary for wood and iron workers to serve the same length of time. Now under the old apprentice system it was

quite possible for a person to spend his whole apprenticeship at one particular part or branch of the business, and at the end of his term to know nothing whatever beyond the actual operation of which he was in charge.

This system has almost entirely passed away and its abolition can be fairly considered due to the superior intelligence of the people brought about by the public schools. It is generally conceded that a good school is a paying investment in any town or State. Intelligence is an assurance against poverty. Diversity of industry has been encouraged and multiplied by trained minds. Invention is surely not the mother of ignorance.

Education that has a practical side will be of value to the person receiving it in proportion it bears to his future vocation. A textile school will benefit a textile worker by enlarging his mind and filling it with useful knowledge. It is not now necessary for a young man to spend seven years learning the carpenters' or machinists' trade, nor spinning or weaving. The boy grows into a man during this period, and if two or three years can be spent in a school where his ambition will be encouraged and stimulated by competent teachers, there is no doubt but that he will graduate with a general knowledge of the technical part of the business which will require only a few months of practical application to enable him to grasp the whole situation, and be better able to cope successfully with the competition that becomes keener and more severe every year.

At the present time, so far as I know, there is very little originality or invention applied to designs for fancy cotton cloth in this country. The usual method has been to copy from foreign goods which have a large sale at good prices the first year they are put on the market. As soon as it is found that certain styles are selling well, samples are sent to the different mills and imitations are made which go into the market to compete with goods a year old. The milk in the cocoanut is pretty low, but we are obliged to be content with any that may be left. The minds which originated and designed these foreign patterns

were trained and enlarged by the textile schools which abound in England and on the continent, and which are supported and encouraged for that very purpose. Another point which is worth bearing upon is that of overseers for our mills. It is not any easy matter to find thoroughly competent men to take charge of the different departments. A great many who have spent the greater part of their lives in the mill and have a practical knowledge of the machinery, are debarred by lack of education, and while a high school or even a grammar school course is not indispensable to an overseer it increases his value materially. We know young men leaving school and entering the mill to learn the business are often discouraged by the drudgery of the work and slow manner in which promotions come around, but with a technical school in their vicinity and a few months' study with a competent teacher, they can, if they desire, start work half way up the ladder instead of commencing at the very bottom.

A textile school is an institution which will reflect credit upon its promoters and supporters, and will exert a most powerful influence upon the cotton industry of this State. It will be a relief from stagnation and sameness. It will supply a theoretical and practical education to the worker, making him a factor of great value, and add new life to the work by the application of higher standards of beauty and excellence.

If we are to continue in the cotton industry, it must be done by brains that are educated and with artists' skill, so that we can adapt ourselves to the more advanced stages of textile work. Give to the rising generation in Massachusetts textile schools, and in another decade you will have the best and most skillful textile workers in the country, and also greater diversity of textile work, on account of the inventive genius developed by such schools.

Mr. ARTHUR H. LOWE. In my opinion, the State will derive many invaluable benefits, and while I shall be very brief, I wish

I could provoke a general and thorough discussion of this subject.

It was the opinion of some, that special textile instruction should be made a part of the curriculum at the Massachusetts Institute of Technology, and receive some state support there, but I am convinced that the idea was wrong. That plan would have limited the benefits to the membership of that institution.

The best results are going to be accomplished, and the greatest benefits derived, from schools located right in the midst of the textile industries, where the benefits may be enjoyed by all who are inclined or ambitious enough to take the courses of instruction either at the day or evening classes, for there certainly should be evening classes for all those who work in the mills and cannot attend the day classes. But this is rather an opinion of when, and what, the schools should be, rather than of what the benefits are to be, and upon that score I need not worry, knowing as I do, that one of the brightest and best fitted members ot this Association, at a great self sacrifice, is going to undertake the establishment of one of these schools, and I believe the influence of this Association will do much to insure the success of all that are established.

These textile schools will draw to the community where they are located, both from within and without the State, young men and young women who are ambitious to become proficient in the textile art. These schools will raise the standard of intelligence among the textile workers in the whole community where they are located. The instruction and information imparted to the members of the schools will be discussed and scattered by all who are in any way interested in the textile industries, and reach many who would otherwise have no interest. These textile schools will equip men to become designers, overseers, superintendents and managers, and leaders in the art who now lack the opportunities of advancement. They will turn out scientific, intelligent, trained and thoughtful manufacturers; they will do much towards meeting the sharp competition of the

foreign and home manufacturers. We are obliged to admit that most of the new designs and novelties that command the most profitable prices, originally come from the foreign mills having in some way the benefit of successful textile school training. The textile schools by disseminating reliable information and right ideas, will be a great influence for good in harmonizing the employer and the employe, and do much towards the overthrow of the baneful power of the walking delegate.

Another and very important benefit to be derived from these schools, is the acquaintances, friendships and associations that will be formed and continued through life by the members of the classes. The pursuit of knowledge is common ground, where all classes can meet and evenly compete.

The PRESIDENT. There are others who are prepared to speak on the subject of textile schools, but I desire to call your attention to the exhibit of the Lowell School of Practical Design.

MASS. INSTITUTE OF TECHNOLOGY.—LOWELL SCHOOL OF PRACTICAL DESIGN.

The following designs were exhibited in the Hall, made by pupils under the instruction of Mr. CHARLES KASTNER, director of the school. The exhibit was made through the courtesy of Gen. FRANCIS A. WALKER, LL.D., the President of the Massachusetts Institute of Technology.

Wilton Carpet with Fleus-de-lis,
By AUSTIN R. MOSMAN, of Boston, Mass.

An Oriental Rug,
By Miss NELLIE BLISS, of Quincy, Mass.

Oriental Rug,
By Miss ADELAIDE S. BEBEE, of Hampden, Mass.

Wall Paper with Frieze, combination of yellow and white scroll,
By Miss RENA HILTON, of Hyde Park, Mass.

Wall Paper and Frieze, violet ground with wreaths of violets, in violet and white,
By Miss HARRIETTE L. CHAMBERLAIN, of Boston, Mass.

Wall Paper, Frieze and Ceiling, a white background with yellow roses,
By HOWARD SOUTHWORTH, of Deep River, Conn.

Wall Paper and Frieze, combination of white scroll with clematis,
By Miss CLARA B. VAUGHAN, Hyde Park, Mass.

Paper and Frieze for library,
By Miss CHAMBERLAIN, of Boston, Mass.

Imitation of Embossed Leather for wall paper,
By Miss ELIZA P. TUTTLE, of Hyde Park, Mass.

Wall Paper and Frieze, in a combination of yellow and white,
By Miss HELEN P. PIKE, of Worcester, Mass.

Wall Paper and Frieze, of Moorish design,
By Miss BLISS, of Quincy, Mass.

Design of pine cones for wall paper,
By Miss ELIZABETH M. HAGERTY, of Boston, Mass.

Wall Paper and Frieze, design of yellow fleur-de-lis and white lace on a yellow background,
By Miss HELEN P. PIKE, of Worcester, Mass.

Wall Paper and Frieze in three shades of old blue,
By Miss NELLIE BLISS, of Quincy, Mass.

Wall Paper and Frieze in Louis XV. style,
By Miss CLARA B. VAUGHAN, of Hyde Park, Mass.

Wall Paper and Frieze, wild carrot design, in white on lavender ground,
Also two Silk designs, one in black, red and white, and one of currant vines in yellows and browns,
By Miss HATTIE S. TAGGARD, of Nashua, N. H.

Two Print designs in black and white,
By WILLIAM E. BRALEY, of Fall River, Mass.

A design for Oil Cloth,
By Miss WHEELER, of Dorchester, Mass.

The PRESIDENT. We will now pass to the next paper on "The Future of Cotton Manufacturing in the South," by Mr. D. A. TOMPKINS of Charlotte, N. C., who has been broadly affilliated with the subject.

THE FUTURE OF COTTON MANUFACTURING IN THE SOUTH.

MR. D. A. TOMPKINS, Charlotte, N. C.

Any consideration of the future of cotton manufacture in the South, necessarily involves a consideration of many separate factors entering into such a matter.

In any section that is at any time leading in any manufacture, the average of all the conditions must exceed the average of other sections, and no condition must be so bad as to destroy the value of all the others.

Amongst the important conditions surrounding the manufacture of cotton are:

1. Raw material. Quantity, quality and price.
2. Labor. Quantity, quality and price.
3. Climate. Temperature, humidity.
4. Markets.
5. Transportation facilities.

In the early days of the Republic, manufacturing interests were more developed in the Southeastern part of the United States than in any other portion. With every other condition remaining the same,—that of labor only changing—the manufacturing interests of the Southeast constantly declined, until 1860 it had reached a condition of insignificant consequence, as compared with other sections of the country or as compared with its agricultural interest.

The State Board of Agriculture of South Carolina, in 1880,

caused to be published a book descriptive of the resources and industries of the State. The following quotation from this book from an article on the subject of manufactures, gives a fair idea of the change which came about in manufacturing interest of that State within fifty years.

The writer says, "Nevertheless, from an early period numerous processes were invented and practiced by the people of Carolina in rendering raw material suitable for business uses. Such was the extraction of indigo, in the middle of the last century, and notably the inventions for threshing and cleaning rice. Power mills accomplishing the latter purpose were first invented in this State, and have since served as models in this important industry for the rest of the world. South Carolina was also the first State to pay ELI WHITNEY for the use of his invention in cleaning seed cotton. The first water gin was erected by Captain Kincaid, on Mill Creek, near Monticello, Fairfield County, in 1795, and for many years, dating from 1801, the Boatwrights, of Columbia, were the great manufacturers of cotton gins for the South. Before and during the Revolution the families of planters and their slaves were clothed in cotton homespuns made in the State. A factory, weaving these goods for the supply of the adjacent country, was established some years previous to 1790, by the Scotch-Irish settlers, at Murray's Ferry, Williamsburg County, and Mr. BENJAMIN WARING established, in the latter part of the last century, a cotton factory near Statesburg, for spinning and weaving "Manchester cotton stuffs." At this time, there were in York, Greenville, Spartanburg and Anderson, seven iron works for extracting the metal from the ore, and working it. The one in York, possessed a forge, a furnace, a rolling mill, and a nail manufactory, and was operated by an improved water blast, the invention of Mr. HILL, one of the proprietors. There were five fulling mills in the upper country, and three excellent wheat merchant mills on Pine Tree Creek, Camden County, one of which, thought to be equal to any in the United States, produced fifty barrels of

superfine flour per day. By the census returns of 1810, the Carolinas, Georgia and Virginia, manufactured greatly more in quantity and in value than the whole of New England together. These facts, at least, make it plain that neither the original character and activites of the people, or their natural surroundings, such as climatic or physical features of the country, were hinderances to manufacturing pursuits.

"That manufacturing has not held a more prominent position among the occupations of the people is by no means wholly due to the great profits accruing to agricultural pursuits. The improvements in spinning and weaving, the invention of the power loom, the development of great iron ore and coal resources, and the consequent activity in the manufacture of machinery of all sorts, which took place in Great Britain in the earlier part of the century, distanced competition in other countries, making English goods far cheaper than any produced elsewhere. But the chief obstacle to manufactures in South Carolina was the institution of slavery. The large land holders had a monopoly of labor, which, in common with all other monopolies, was adverse to the development of manufactures. More than this, the sentiment against slavery, which spread about this time throughout Christendom, isolated the industrial institutions of the South. Forced by the necessity of the case to stand by the institution with which, against her protest, she had been burdened, she faced single-handed the public opinion of the civilized world. Feeling that every man's hand was against her, she became suspicious of strangers. Immigration ceased almost entirely, and the elbow-touch with the great industrial advance of the age was lost; resigning herself almost as exclusively, as she was elsewhere excluded, to agricultural pursuits, South Carolina satisfied hereself with such profits as were gained in the culture of cotton, and produced the largest amount of the raw material ever offered in the markets of the world. Even then, South Carolina was not unmindful of the great advantages to be obtained from diversified pursuits, and the development of manu-

factures. Propositions for employing slave labor in cotton factories were discussed, and ninety-eight negro slaves as operatives, under a single white overseer, were successfully worked at the Saluda factory, near Columbia, in 1848, and in this same factory, destroyed during the war, and rebuilt since, mixed operatives have been employed, and the negro has been found as capable of learning within certain limits, as the white."

What is here said of South Carolina, is equally true in general terms of Virginia, North Carolina and Georgia. During the period in which manufactures declined in South Carolina, all other conditions, excepting that of labor, remained the same or became better. Raw material became in the same period more and more abundant, cheaper, and the quality remained quite as good as it had ever been. Climatic conditions remained the same. Markets increased. Transportation facilities were improved. Yet, in consequence of a material change in the condition of labor, a well established industrial interest declined and became practically eliminated as an important factor in the section being considered.

Still more remarkable, was the quick re-establishment and rapid growth of industrial interests that followed another change in the labor conditions. In this instance, also, all other conditions remained the same.

In the light of events subsequent to the Civil War, it is now plain that the institution of slavery was alone sufficient to destroy the value of all the conditions in the southeast, that in themselves were favorable to manufactures.

It transpires also that the abolition of the institution without changing any other condition, has been sufficient to re-establish industrial interests, and the average conditions are now such as to conduce to their rapid growth. This applies not only to cotton manufacture, but also to iron and other industries.

It becomes at once apparent from the history of the southeastern section, and from the present condition of manufactures in the South, that the single condition which stifled manufac-

tures in the ante bellum days is now removed. The future of cotton manufacture in the South now becomes one of her ability to maintain the present conditions. If this can be done, her growth in the manufacture of cotton is practically without limit, because at the present moment it seems probable that the average of all the conditions now existing at the South is better than the average of those of any other section of this country, or of any other country. I think that enough is now known of the conditions surrounding cotton manufacture in the South to warrant the claim of superior average conditions for coarse goods, without argument of the subject here. It seems also fair to assume that the making of finer goods is only a question of increased knowledge and skill, both of which come with time and experience.

What, then, are the probabilities of continuing the advantages now held by the South?

In the matter of raw materials, the chances are all with the South. The production of cotton will continue to increase, while improved methods and a better cultivation of the soil will conduce always to a tendency to lower average prices. Thus the freights, and other charges for its transportation to other manufacturing centres, become a large percentage of the cost, which is in favor of the South. While the quantity of cotton produced will increase, and the average price decrease, something will be gained in quality by a knowledge on the ginners' part of the requirements in a cotton mill.

Climatic conditions are not unfavorable, and these will remain the same. The mean temperature of the Piedmont region is not materially lower than that of the spinning area of Pennsylvania and New England. The humidity in the three sections is not materially different when the whole of the respective areas are considered. In each section it is better in most cases, and necessary in many cases, to use artificial means for regulating the condition of humidity in a cotton mill. As means of artificial humidifications are improved, the natural condition be-

comes of less importance. Therefore, in respect to humidity, there is probably nothing that the South needs to apprehend.

The larger factors now left for consideration in relation to other sections of this country, and to foreign countries, are labor, markets and transportation.

As to labor, what is now in the southern cotton mills is good enough and also cheap enough. But the quantity is not unlimited. There is, however, another source of labor in the South, not at present drawn upon for cotton mill work. At the present rate of mill construction in the South, it will not be many years before all the available white labor will be occupied. Then the competition of white labor will probably bring up this question of colored labor. If it is successful then the question of labor for cotton manufacture in the South will be fixed for a long time to come. If it transpires, for any reason now unforseen, that it is impracticable or unprofitable to use colored labor, then the labor conditions at the South will gradually approach those in the Middle and Eastern States. In this latter case the tendency of cotton manufacture would still be southward, because of other more favorable conditions, such as cheaper raw material and a milder climate. This could only be checked by legislation fostering and preserving your industries. I doubt if it could ever be brought about, that any one section of a country, or of the world, could monopolize such an industry as that of cotton manufacture. It may be destroyed in any one section by one adverse condition, and yet all the conditions necessary for its success are so simple that they may be created in many places by fostering legislation and the intelligent conduct of the people. We have already seen how the making of one system of laws relating to labor destroyed an important industrial development, and how the destruction of a system of labor (slave labor) caused a revival at once in industrial pursuits. Barring the introduction into the southern cotton mills of the great mass of black labor, then the cotton mill labor North and South will gradually find an equal level of conditions.

If the colored man is ever much employed in southern cotton mills, it will probably be in mills organized throughout with colored labor. It will also probably not be competitive with the white labor, but rather secondary to it. As the present white labor acquires more skill and gains more knowledge, it will be utilized in finer goods, and in operations that require greater and more training. By this means room will be left in the manufacture of coarser products for a thorough test of the adaptability of the colored labor and for its continued use, if found profitable. The labor market will undoubtedly be supplemented in this way to some extent. To what limit, nothing but time and experience can prove. In the iron trade, in coal mining, in the oil mills, and in many other industries, colored labor is now much used, yet it always has a fixed and definite position with reference to white labor. Nothing has so far been done in the cotton factory to determine the status or basis upon which the labor of both races may be utilized. As indicated in the foregoing page, it will probably be upon the plan of working the two races in separate mills, surrendering to the colored people the coarser and heavier work. If the colored population can be drawn upon for labor in cotton mills, as it has been drawn upon for labor in other industrial occupations in the South, the work being done under the direction of, or secondary to the occupations of the white race, then it may not be an error to predict for the South a practical monopoly in the manufacture of coarse cotton goods as well as the production of cotton. My own belief is, that as the present white population of the South moves forward in skill and knowledge, colored labor will take the place left vacant in the labor market by the advancing white race. There will be no competition, no friction, and no ill will. The good nature of the colored man commands always the best wishes of his white neighbor.

With such a solution of the future labor problem of the South, then such a production of goods can soon be reached as would soon glut our domestic market. Then the subject of market

and transportation become of the greatest importance. Omitting entirely any discussion of what is a proper policy as to protection against the competition of countries that are older and more experienced in manufactures than we are, there is no question in my mind, but that we ought to have the most liberal reciprocal trade relations with all countries that are younger and less experienced in manufactures than we are. Our domestic markets are the best in the world. Our domestic transportation facilities are not only unsurpassed, but are far better than those of any other country. But more cotton is produced in the United States than can possibly be consumed in the domestic trade. The remainder is exported. Why may we not hope to manufacture the entire cotton production and export the manufactured product? In order to make headway in this direction, we need American shipping interests and liberal reciprocal trade relations with those countries whose natural products we might consume, to whom we might sell our manufactured products. Any system of protection should foster and protect our foreign as well as our domestic trade. The first necessity for the protection of foreign trade is an American merchant marine. Our excellent domestic markets have been created by the constant extension and improvement of transportation facilities. Without these facilities, but with every other condition favorable, our domestic trade could not possibly be the half of what it now is. So also with every other condition favorable to a large export trade in cotton goods, but with scant and awkward transportation facilities the business lies almost as completely untouched as though we could not raise the cotton or could not make the goods. In the natural products of many countries we have some trade through England and in English ships. It is not natural that that country should try to facilitate the shipment of our manufactured goods back in return. It suits her far better to take our raw cotton back to England and there produce the goods to be exchanged with the consuming countries for their natural products.

As the institution of slavery stifled all manufactures in the South in the very pressure of all other favorable conditions, so is it now possible, and to my mind probable, that a large and excellent market in many parts of the world is being lost to us for want of convenient and quick means of inter-communication. New England, as well as the South, should be interested in all plans for creating and maintaining an American shipping interest. Protect it by subsidies, if necessary, until it is made self-sustaining. Without the relief of foreign markets, New England and the South will soon be in a life and death conflict in our domestic market. I believe the South is best equipped for such a conflict. With the greater markets that a successful American shipping interest would bring to us, there would be no need for losing competition between the two sections. Together, the two sections might ultimately manufacture all the cotton made in this country. There would be plenty of work in the various departments of trade for white and black labor alike, without an unnatural competition in that line, or even between the white labor of the North and the South.

In conclusion I may say that it seems to me that if our trade in cotton goods is to be confined to this country's markets alone, then there are advantages in the South which will give to that section the bulk of the trade. This means grinding competition for both sections for a long time to come. Mills will undoubtedly continue to be built in the South whenever trade is fairly good. Relying alone on domestic markets, times of depression are bound to come. In each recurring depressed period, the competition must become sharper and sharper. Instead of expanding business to occupy our colored population in our mills to meet a growing trade, it may be drawn upon to make goods that the South may sell cheaper than you can compete with at fair prices for your labor.

The growth of cotton manufacture in the South has been chiefly in the Piedmont region. It will probably continue to grow in the same territory rather than extend over the South as

a whole. This is partly on account of better climate in the Piedmont region, but is principally due to the labor conditions. The agricultural interest of the Piedmont region has never been so prosperous as the coast or Mississippi valley regions. On account of this difference, occupation in a cotton mill in the Piedmont section is rather more attractive than farming. On the other hand, in the more favored agricultural sections, farming is attractive enough to make it much more difficult to keep up a cotton mill organization.

The area of cotton manufacture in the South will probably continue to extend as population increases. The manufacture of cotton goods in the South will continue to increase. If we find the means to extend our markets in the same proportion as the manufacture increases in the South, then the entire spinning area of the United States may enjoy prosperity for a long time to come.

The PRESIDENT. We will now resume the topical questions, and I will ask Mr. WILLIAM J. KENT to open the discussion on number one, "How many ends per thousand spindles should be allowed to be broken down in a spinning room where the roving is furnished well prepared and the yarns vary in numbers from 20 to 80?"

Mr. WILLIAM J. KENT. This subject was suggested to the Board of Government of your Association by your humble servant, the reason for which is, that I have become of late very much interested to see how closely a spinning room can be run, not only in cost but in production also. I have established a system in the mills which I represent, where we get by count, once a week, the number of ends down in each spinning room.

I have also another system established by which this can be figured out and compared. This I get by weighing the spinners' waste each day. I will cite to you for example several spinning rooms which are on various grades of work, and will give you the kind of work they are on, also the speeds the front rolls are running, which I call moderate.

You will notice I do not give the speed of the spindles; this is something I care very little about as I always look to the speed of the front roll, as that is the part of the machinery which delivers the yarn, and with the modern spindle you can always get as much speed as is generally wanted. Economy in regard to speed of spindles does not come under this topic and therefore would not be proper to discuss at this time.

In our No. 2 mill we have a spinning room which contains 48 frames, containing 10,752 spindles; these 48 frames are running on various numbers; sometimes they will be running on three numbers, No. 30's, No. 36's and No. 40's; at other times there will be four and five numbers, but all within the range given. This room averages 97.55 ends down by count; by waste made 96.

The speeds of the front rolls are:

No. 30's, 110 revolutions per minute.
No. 36's, 108 " " "
No. 40's, 102 " " "

In our No. 3 mill we have a spinning room which contains 48 frames containing 11,904 spindles, these 48 frames are running on various numbers, from No. 20's to 30's. This room averages 113.53 ends down by count; by waste made 100.

The speeds of the front rolls are:

No. 20's, 128 revolutions per minute.
No. 23's, 116 " " "
No. 25's, 114 " " "
No. 28's, 112 " " "
No. 30's, 110 " " "

In our No. 4 mill we have a spinning room which contains 88

frames, containing 22,704 spindles; 12 of these frames are running on No. 60's combed Allen Seed, 24 of them on No. 40's carded Peeler and 52 on No. 45's carded Allen Seed. This room averages 119.09 ends down by count; by waste made 110.5.

The speeds of the front rolls are:

No. 40's, 102 revolutions per minute.
No. 45's, 91 " " "
No. 60's, 88 " " "

In our No. 5 mill we have a spinning room which contains 98 frames, containing 26,432 spindles; this room has 16 frames running on No. 80's, 72 on No. 60's, all combed work, from Allen Seed cotton. This room averages 120.74 ends down by count; by waste made 145.

The speeds of the front rolls are:

No. 60's, 88 revolutions per minute.
No. 80's, 74 " " "

In our No. 6 mill we have a spinning room which contains 96 frames, containing 23,520 spindles; this room has 16 frames running on No. 28's, 20 on No. 36's and 60 on No. 25's. This room averages 184.61 ends down by count; by waste made 168.

The speeds of the front rolls are:

No. 20's, 128 revolutions per minute.
No. 25's, 114 " " "
No. 28's, 112 " " "

The frames in our No. 2 mill are running on 6-inch traverse, 1⅝-inch ring, but are being changed over to 7-inch traverse, 1⅞-inch and 2-inch rings.

The above remarks apply to our No. 3 mill.

Our No. 4 spinning room is running on 6-inch traverse 1⅝-inch ring. In this room I propose to run a much larger ring as soon as the present rings commence to wear out.

In our No. 5 mill we are running 6-inch traverse on No. 60's, 1⅝-inch ring, and on No. 80's 5½-inch traverse, 1⅝-inch ring.

Our No. 6 mill, most of which is on No. 25's yarn, is running on 7-inch traverse, 1⅞-inch ring.

Taking the whole number of ends down, which is 635.52, and dividing this by the total number of spindles, which is 95,312, we have $6\frac{66}{100}$ ends down to every thousand spindles by count, and by the same process we have $6\frac{49}{100}$ ends down by waste.

It is impossible to get an accurate account of the number of ends down, either by count or by the waste made, but I think that I have given you a close approximate. There are other methods now being used but which I think are as faulty as mine.

Now some of you may ask, do I consider this the best that can be accomplished? I shall answer you that I do not consider that any of the rooms mentioned are run as well as they should be, but I will tell you what I am striving for and shall not be satisfied until I have accomplished it.

On numbers ranging from 20 to 30, five ends per thousand spindles should be allowed to be down; on numbers ranging from 36 to 45, four ends to be down; on numbers ranging from 50 to 80, three ends to be down. This result will not be difficult to accomplish if you can obtain good overseers who take an interest in their rooms and have the proper machinery and supplies.

This subject is so interesting, to me at least, that I could go on and talk much longer and give many more facts and figures, but my time is limited; consequently I must draw my part of this discussion to a close, but before doing so I want to say that it is most important to have your cotton well bought, well selected for the different kinds of work, and well handled all through each process.

Mr. ALBERT F. KNIGHT. I was not here when Mr. KENT first began his discussion, and I would like to ask him to explain how he makes a comparison of the number of ends down per revolving spindles that are actually down, as compared with the waste that is made. I know how it is, but I think it would be very interesting to the members of the Association to hear it.

Mr. WILLIAM J. KENT. Mr. KNIGHT and I have had a good deal of talk on this subject, and it was by visiting his mill first that I began to keep this account. I go through each room once a week and render an account of the number of ends down by actual count. Then we keep run of the waste that is made, and that is figured up every week and compared; but it is not an acccurate account, for there will be waste going into the sweepings, and you will notice from my report that the figures given are fairly close, much more so than I expected to find them.

Mr. ALBERT F. KNIGHT. I have not prepared anything specially on this subject. I had thought that I would, but I have been very busy the last few weeks, and I will simply tell you some of the experiences that I have had which led to the methods that I adopted to find out how the spinning was running. When I was somewhat younger than I am now, working in various parts of the mill as second hand, overseer, etc., I made experiments, as we all have, trying to better the condition of affairs, and sometimes I thought I had struck an idea that was going to give good results, and I would ask how they thought things were going, for instance, in the spinning room. The operative who was working on the spinning frames would look at me and I could see that the evident intent was to reply as they thought that I wanted them to. They knew I was trying to make the work go better, and they wanted to make me feel good, so they said, "I think that is going better, Mr. KNIGHT," and frequently I presume you have had the same experience. I would go on and increase the number of machines I had put on in this system of drafts or twists, or whatever the change was I had made, with the idea that it was an improvement, and before I had gone a great ways I found it was far from being an improvement; that I was going in the wrong direction. Then I would get back again as soon as I could and talk the matter over with those who had been interested in the experiment with me, and we would conclude it must be the

stuff. Perhaps the stock was better, when we first started on the experiment, etc. So far as I know from talking among my friends, the usual custom in making experiments in a cotton mill is to try a thing, and by observation and inquiry among the operatives decide as to whether it is running better or worse as a result of the change. I reached the conclusion that that was not the proper way to try experiments, and I adopted the plan of keeping records of everything that I tried, and at the Amory Company we adopted the plan of keeping not the number of ends down per thousand spindles, but the number of ends down on a side on a spinning frame. I might say we kept records all the way through in our spinning, warp and weaving, etc., and the standard which we adopted was 120 spindles; and on 28 yarn, anything less than 45 ends down on a side of 120 spindles a day, we called running well; if it went above that, we felt our spindle was running poorly. I have adopted that method for the Berkshire Company, and I find we can with safety expect a less number of ends down on the fine work than we can on the coarser yarns with shorter cotton and the inferior process of handling it.

As many of you are interested in manufacturing print cloth, I will say that I think if you succeed in the average print cloth mill, with cotton of the usual grade used for making those numbers, in keeping the spinning down to less than 50 ends on a side of 120 spindles, I think you can safely conclude your mill is running well. But if you go above that, I think you had better look into your methods and see if you cannot improve. I do not say it is not possible to have better spinning than that; but I will state that it is unnecessary to have anything poorer than that.

The PRESIDENT. Is there anything further to be said on this topic? If not, we will pass to number eleven, "What means can be used to prevent the formation of anchor ice?"

Mr. F. P. VOGL. The past winter was a bad one because of anchor ice, and I will give the means I used to stop it from coming into our racks. The best method when weather is cold enough to freeze nights and the greatest help to us was as follows: we took a good sized rope, with a piece of 2 x 4-inch joist attached to it, and put it across the river above the dam; this served as a boom holding the anchor ice on surface, and in an hour the river was covered above and beyond the rapids, effectually stopping the ice. In cold weather we have dropped ropes into the anchor ice in front of racks, about two feet from rack, and when the ropes freeze into the ice we hitch them to bulkhead racks, forming a fender which keeps ice away from racks. Twice this last winter we have had our pond full of ice, and I have used a stream from our hydrant, 80 pounds pressure, and made channels through the pond and in this way got the water to our rack; such a stream does good work in dislodging the ice from top of dam and thus gives chance for ice to go along. The rope across the river, with 2 x 4-inch joist or some about that size stick, is a sure cure for anchor ice with our stream, and may be for others.

The PRESIDENT. Topic number twelve, "What can be offered on the subject of the influence of moisture in the air affecting the strength of yarn?" will be omitted, and topics thirteen and fourteen will be considered together: "What is the quantity of steam properly required for slashers and the best means of applying the same?" "What steam pressure should be carried on slashers running on colored work, and what is the best means of returning to boilers the condensation from slashers?" On which we will first hear from Mr. CHARLES T. MAIN.

Mr. CHARLES T. MAIN. On March 8th and 9th, 1888, I made some tests for the purpose of ascertaining the amount of

steam required for slashing at the Lower Pacific Mills. There were four slashers in all, three single, Howard & Bullough, and one double slasher, Lowell Machine Shop. Size of cylinders, seven feet and five feet diameter and five feet wide. The method of making the test was as follows: the water from the slashers was collected in a tank and weighed and the steam pressures taken at the slashers every time a tank was emptied. The yarn was also weighed and a record kept of the weight and number. The tests lasted throughout the day. The results obtained are shown in the following table:

Day. 1888.	Number of Yarn.	Pounds of Yarn.	Average Number of Yarn.	Pounds of Water Condensed.	Average Steam Pressure at Slashers.	Average temperature at which water could be returned to Boilers.	Equivalent weight of water from and at 212° F.	Equiv. weight of water per hour from and at 212° F.—Col. 8 ÷ 10 5-6.	Av. H. P. required at 34½ lbs. water from and at 212° F. per H. P.	Equivalent weight of coal at 11 lbs. water per lb. coal from and at 212°—Col. 9 ÷ 11.	Maximum H. P. for one hour.
March 7	40	2800		10,000							
Wednesday	28	1508	35.8	(a) 500	8.06	(b) 175°	10,987	1014	29.4	92	About 50
		4308		10,000							
March 8	40	2988		10,212							
Thursday	28	1280	36.4	(a) 511	8.56	(b) 175°	11,227	1037	30.1	94	
		4367									

(a) 5% allowance was made for steam used in boiling and warming size, and losses by condensation in supply pipe and leakage.

(b) If condensed water were not returned to boilers, but wasted, there would be required about 12% to 13% more coal for producing this steam.

The following deductions are made from the table: Pounds of steam required per pound of yarn of average 36's, about 2½; average horse power of boilers required for one slasher, about 8; maximum horse power of boilers required for one slasher, about 12 to 13.

The second part of the question is a little ambiguous. I am not quite sure whether the word applying does not mean supplying. The best method of supplying the steam depends somewhat upon the local conditions. If the mill has compound condensing engines the proper source of supply is the receiver between the high and low pressure cylinders, if a sufficiently high pressure can be obtained which is constant. If it has non-condensing engines the exhaust can be used if a sufficiently high pressure is required for other purposes to properly do the slashing.

There is no doubt that the slashing can be done on a very low pressure, but the time required is longer and the saving of steam by using exhaust of low pressure instead of live steam must be set against the loss of wages, interest, etc., on plant.

In July, 1888, I made a test to get some idea of saving or loss in using exhaust steam for slashing. With 10 pounds pressure the speed of the slasher was 26 per cent. higher than with 4 pounds with the yarn properly dried.

The wages paid were 16 cents an hour for tender; 6 cents an hour for a half helper; a total of 22 cents an hour.

A production at the lower speed equal to an hourly production at the higher speed costs about 26 cents for labor, showing a saving of four cents an hour or 40 cents a day when using the higher pressure. If a pound of steam in a compound engine goes into the low pressure cylinder, there will be rejected or lost about 1,100 heat units. For every pound of steam taken from the receiver into the slasher and the condensed water returned to boiler, there will be lost about 100 heat units. 1,100–100= 1,000 heat units saved by each pound taken from the receiver, or about 90 per cent. of the heat saved, and therefore 90 per cent. of the coal. One boiler horse power equals three pounds

of coal; eight horse power per slasher equals 24 pounds of coal per slasher an hour. 24 x .90=21.6 pounds saved per hour, or 216 in 10 hours. This at $4.50 for 2,240 pounds, equals 43 cents saved a day, or the saving in coal just about offsets the loss in wages.

From the above it would seem that it makes but little difference in total cost of steam and labor whether exhaust is used at four pounds pressure with decreased production, or 10 pounds pressure of live steam with increase in production. If a high enough receiver pressure can be maintained so that the same production is obtained as with live steam, the saving would be 0.43 per slasher a day or $129 a year of 300 days for each slasher. It is important to have the steam pipes leading to the slashers of ample size, especially for low pressure steam, so that an ample supply may be furnished to the cylinders.

In regard to Topical Question No. 14, "What steam pressure should be carried on slashers running on colored work, and what is the best means of returning to boilers the condensation from slashers?" I would state that

I have had no experience in slashing colored yarn, but an old overseer of many years' experience, told me that he found two pounds to be the proper pressure for his work on coarse yarns. Probably as good a method as any of returning the condensation to the boilers is by using a receiver pump which works automatically, the exhaust from which should go into the feed water heater together with the exhaust from feed pump, etc. If the open heater is used it can be returned into that. If live steam is used there will be no danger in returning the condensed water to the boilers, but if exhaust has been used it might be unsafe to return it unless the grease has been taken from it in some-way. If the condensed water is not returned the loss will not be great, being not over 150 heat units on an average per pound of steam, and with coal at $4.50 a ton, the loss for each slasher would amount to about $22 a year, at the most.

It does not pay to take any chances in returning water to the boilers which may contain oil, especially in places where the mill has a supply without purchasing it for that purpose. The re-use in the boilers of condensed steam from an engine has in many instances caused serious trouble with the boilers. Where town or city water must be purchased for this purpose, it is tempting to try to save this water, but where there is plenty of fresh water obtainable there is no excuse for trying to save it except for the small amount of heat which it contains.

The PRESIDENT. I will ask Mr. WILLIAM G. NICHOLS to continue the discussion.

Mr. WILLIAM G. NICHOLS. Mr. President, I don't feel that I can add anything of value to what has just been said. My experience has not been wide enough to give anything of more value. I have made some inquiries on this sort of work, and I find that more work can be done on steam direct from boilers than by exhaust steam. One manufacturer told me a few days ago that he had ten slashers, and he was using steam directly from the boilers; but he was at one time trying to use exhaust steam when necessary on account of low water, and he had found he could do less work on the slasher using exhaust steam than with the direct steam, the steam no doubt being more moist and condensing more quickly. In the report it says one gentleman of experience had found two pounds to be about the right pressure for heavy yarn. Another gentleman told me on account of running heavy yarn he carried fourteen pounds; that he thought necessary to get more heat and more quickly the return of heat from the boilers, strikes me as another argument in favor of the direct steam.

The three following methods are in common use and which is to be considered the best in any given case depends upon the attendant circumstances. First, to discharge the drip from the slasher to the open air, to waste. Second, to run the condensed

water to a hot well and return it to the boiler by a pump or other means. Third, to return the water of condensation directly to the boilers through a trap. There is likely to be this trouble if the attempt is made to use the exhaust steam from the slasher in a receiver which is also connected with the heating pipes of the mill, namely, that the pressure will be so different that water will be backed up either to the slasher or the heating pipes.

Mr. A. TENNEY WHITE. The tests that were made by me were on a Howard & Bullough slasher, cylinders 7x5 feet and 5x5 feet. The first set run was of 5100 ends of No. 40 yarn, or a little coarser. This heavy sley completely covered the face of the cylinder and we found by collecting all the water used, and the total pounds of yarn slashed, it took 1.91 pounds of water or steam to one pound of yarn running at the rate of 28 yards per minute and carrying a pressure of 3 to 3½ pounds. On lighter sley goods where more of the cylinder was exposed or in other words, less covered with yarn, it took up 2.04 pounds water to one pound of yarn, same number speed, etc., as before. Every particle of condensation was carefully weighed, and this included the starting of the slasher up at noon and in the morning when they are cold. It was meant to represent a day's run of the slasher under ordinary circumstances. Much more could be said regarding the test, but this is the result in as few words as practicable.

The PRESIDENT. I will call upon Mr. OSCAR B. TRUESDELL to continue the discussion on number fourteen.

Mr. OSCAR B. TRUESDELL. The best arrangement I have seen for returning to boilers the condensation from slashers, is by the use of the "Bundy Trap" made by the A. A. Griffing Iron Co., 177 Fort Hill Square, Boston. For some time passed I have been using one of these traps on my slasher at No. 2 mill with the best of success. The trap is placed on the side wall of

and above the boilers, and the discharge from the trap is piped directly into the feed pipe of the boilers. The slasher is four floors above trap, and the condensed water flows from slasher directly into the trap, the steam to work the trap being taken from the top of the boilers. We use a No. 101 trap. This is the smallest size of this style of trap, and it takes care of all our condensation without the least trouble, and so far has required no looking after. We find the trap empties itself on an average of nineteen times an hour, or once every 3.15 minutes, and as the trap holds when full four gallons (so reported by manufacturer), we are returning to the boilers 76 gallons of condensed water per hour, and as it takes but 25 seconds for the trap to empty itself, there is no danger of the condensed water backing up into the slasher while the trap is being emptied.

The thermometer shows the condensed water from the slasher and just before it enters the trap, from observations taken every five minutes, to average 219 degrees, and on leaving the trap and passing into the boilers 254 degrees, a gain of 35 degrees in temperature.

The PRESIDENT. Topic number seventeen, "Can cotton manufacturers do anything more than they are doing at present to prevent the recurrence of boiler explosions? Will the new Massachusetts law which went into effect August 1, 1895, requiring the examination of engineers and firemen, help materially in this direction?" I will call upon Mr. F. W. DEAN.

Mr. F. W. DEAN. Two or three recent boiler explosions and several recent condemnations of boilers which have seen but short service, render the discussion of the above subject important at this meeting. I shall endeavor to show, very briefly, that cotton manufacturers can do much to diminish the chances of boiler explosions, and in doing so I shall make no apology for severe criticism of boiler makers.

In the first place manufacturers should recognize the fact that it is a rare thing to find a boiler maker who uses the best methods and the best kinds of tools without actually being driven to it by engineering opinion. The use of drilled holes, butt joints, hydraulic riveting, machine flanging, and annealing flanged plates have been forced upon them by high class engineering demands. Even now, although these means and ends are well known, there are many boiler makers who possess no modern, if any tools whatever, except a plate bender and punch,and these same boiler makers represent themselves as producing first-class work, and even succeed in obtaining a good many orders. Many boiler makers even bid on specifications that they know they cannot fulfill, and trust to luck to have this overlooked.

It has been said with truth that the first time the materials of boilers are abused, is when their manipulation by boiler makers begins. Manufacturers should take it for granted that most boiler makers are not to be trusted, that they must make every effort to boycott all who do not employ the tools and processes enumerated above, and that the campaign of education that has been begun should be continued. I should add to this something about the benefits that would accrue if the manufacturer should confer with consulting engineers experienced in boiler designing and in shop methods, and have the boilers built from carefully drawn specifications and under inspection.

Some manufacturers who do not pretend to have special knowledge concerning boilers, materials and construction, place themselves in the boiler makers' hands with the belief that they are to have a first-class job, but at the end of four to eight years their boilers are condemned to carry a pressure too low to be of much value to them.

While I have been severe upon boiler makers, it should be said that some complain that their efforts are not appreciated by manufacturers, who very often give a contract to the lowest bidder regardless of his fitness to do good work. This has much justification, but should not encourage any boiler maker

to retain an antiquated plant. It merely shows that the manufacturer, as well as the boiler maker, needs educating.

What, now, is to be gained by the use of the tools and methods referred to?

1. Drilled holes prevent the injury to plates that punching causes. Punching strains plates beyond the elastic limit in the vicinity of the hole, weakens the metal and better prepares it for being attacked by corrosion. Punched holes do not match well and the result is that rivets have a reduced section at the joint between the plates, and do not fill the holes at that point.

2. Butt joints make a shell circular and therefore prevent the bending action that always takes place near the edge of the joint, as pressure is put upon the boiler and the effort to become circular occurs. The working back and forth that this causes cracks the plate.

3. Hydraulic riveting causes rivets to fill holes better than any other kinds, makes tighter joints, and thus prevents corrosion by leakage. As the rivets fill the holes the joint is stronger than if they did not.

4. Hand flanging brings local strains in a plate which, if the plate is not annealed afterwards, often results in cracks. As flanging machines work upon uniformly heated plates, these plates are annealed by gradual cooling without any special annealing process being employed.

In many cases untested plates are put into boilers and may cause disaster. The physical and chemical properties of every plate in a boiler should be known and recorded for reference.

A few words should be devoted to the difficulties under which the boiler insurance companies labor. It is probably no exaggeration to say that no boiler can be inspected both inside and outside. The bricked-up boilers are inaccessible outside, and the tubes prevent the inspection inside. The insurance company is therefore compelled to guess to a considerable extent as to the condition of the boiler, and in order to protect itself, often may condemn boilers prematurely.

I have recently designed a vertical boiler to obviate the difficulty of inspection. The blue prints presented show how all parts of the inside of the shell are made accessible for examination, and it may be interesting to some of the members of the Association to examine these prints to see how it is accomplished.

The drawings were exhibited to the audience.

The PRESIDENT. We will next hear from Mr. GEORGE E. TUCKER.

Mr. GEORGE E. TUCKER. Topical question No. 17 is one of interest to every manufacturer and steam user. To reduce the cost of production, the cost of power has necessarily been a matter of great importance. Foreseeing this, manufacturers have introduced the compound engines, together with higher speeds for machinery, requiring a marked increase in boiler pressures. The average steam pressure of boilers throughout the country in 1876 was 70 pounds. Ten years later these conditions were not very much changed, but today the average is over 100 pounds, and has not yet reached its maximum pressure. The factor of safety in 1876 was five, and over—a factor not over conservative, as claimed by those who speak with authority.

Experience has shown that time and again, boilers constructed for a pressure of 70 to 80 pounds have been operated to a pressure of 100 pounds and over, in which case the factor of safety drops to three; such boilers, by reliable insurance men, are claimed as hazardous and liable to failure. These same men insist that the factor of five for safety for externally fired boilers is not too high and their efforts to induce steam users and boiler constructors to hold to this factor of safety has been agressively maintained, and the result of their labors has been shown by the very small per cent. of explosions which have occurred under their care. During the past year, one of these companies has

insured 61,000 boilers with but nine explosions, a trifle less than one sixty-seventh of one per cent.

The best obtainable material, construction and management are essential to freedom from explosions, nor is the economy of fuel or operation lost by the erection of the best constructed boilers. Such plants have been designed and erected, having the full factor of safety, being simply, but properly, fitted in all connections and have shown economy in connection with the use of compound engines of 1.37 pounds of coal per horse power per hour, proving that economy and safety can go hand in hand with a properly constructed steam plant. At the Otis Company's mills we take the ground that the insurance companies are our friends, and that what is good in the way of protection for them, is equally as good for our company. Of course, in the matter of fire insurance, we sometimes think the companies are unreasonable in their suggestions for sprinklers, but we must acknowledge that the property is better protected when these suggestions are complied with, and we believe the same is true of boiler insurance. No manufacturer can afford to antagonize these insurance men or ignore their suggestions.

I believe the best precaution that manufacturers or steam users can take against explosions is to combine in their plants the very best obtainable material and construction; put the plant in the care of intelligent, competent men, and look after them closely enough to know that they are attending to their duties. To this I would add a due regard for all suggestions and requirements of inspectors sent out by the insurance companies. I would reject the larger proportion, if not all, of the patented appliances (which, if we believe all that the agents introducing them claim, would save all the fuel and make boiler explosions an impossibility) believing that they very largely detract rather than add to the efficiency and safety of a well constructed boiler plant. The laws of Massachusetts requiring the licensing of engineers and firemen cannot but have a beneficial effect, tending to the better care and more intelligent handling of boilers, as

the ambition of the men will be aroused, not only to secure a license but one of the best grade.

Mr. EDWARD W. THOMAS. Relative to the first portion of this question, I can only suggest that in a measure it lies almost entirely with the manufacturer to specify as follows:

Firstly. That all material to be used in the construction of any order for boilers he may give is of the best.

Secondly. That he may employ an expert to see that this is done.

Thirdly. That none but first-class boiler makers be given his order.

There can be no doubt that any manufacturer willing to carry out the above suggestions may reasonably have done the best he could to protect himself and his plant.

The second part of the question calls up at once the fact that, particularly in this State, many of us feel that we have too much legislation, relative to laws designed to throw obstacles in the way of the manufacturer competing successfully with those of other States. While to some degree this may be true, in so far as hours of labor are concerned, I fancy that there are but few of us who fail to recognize the wisdom of some, and indeed many of the laws enacted for the interest of our work people. We are obliged to protect our employees in the line of sanitary arrangements, in preparing means of quick egress from mill buildings in case of fire, of protecting all dangerous running parts of machinery; why, then, ought we not be compelled to engage men to have charge of boilers and engines who are thoroughly efficient and capable?

It is a well known fact that one good fireman, intelligent, and with a thorough knowledge of his duties, will save more than his wages in coal, as against the fireman whose only recommendation is that he can be engaged for a low rate of compensation. The same is true of an engineer. There is no more wasteful machine than an engine not properly adjusted. This, in connection with an engineer not sufficiently posted, is to be

met with not infrequently; and to the manufacturer who is in an inland city where the cost of fuel is high, none too great attention can be paid to the intelligence and capacity of his firemen and engineers. Therefore, the law referred to in the question requiring all firemen and engineers to pass an examination seems to me to be eminently just and proper, as much so as that an engineer on any sea or river craft should be required to pass a similar one. We not only benefit our coal pile by using it economically, but we certainly protect, so far as is possible, the property, as well as the lives, of our employees.